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THE GENUS PENIOPHORA

IN NEW YORK STATE AND ADJACENT REGIONS

STATE UNIVERSITY COLLEGE OF FORESTRY
AT SYRACUSE UNIVERSITY 1960

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PLATE I, A-E. — A. Vertical section illustrating floccose texture (of *P. polonensis*, Brandt, 10-26-56 in SYR-F). × 140. B. Same, illustrating pelliculose texture (of *P. sanguinea*, Slysh 219 in SYR-F). × 140. C. Same, illustrating membranous texture (of *P. affinis*, TRT 24261 in SYR-F). × 140. D. Same, illustrating waxy texture (of *P. nuda*, Slysh 281 in SYR-F). × 500. E. Drawing of a vertical section of *P. nuda* (Slysh 281 in SYR-F) showing microscopic features: (b) basidium, (c) cystidium, (g) gloeocystidium, and (s) spore.

THE GENUS PENIOPHORA
IN NEW YORK STATE
AND ADJACENT REGIONS

ANTON R. SLYSH

STATE UNIVERSITY COLLEGE OF FORESTRY
AT SYRACUSE UNIVERSITY – JUNE, 1960
SYRACUSE 10, NEW YORK
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All figures are camera lucida drawings × 750. The specimen is deposited in the Herbarium of the State University College of Forestry at Syracuse (SYR-F) if the herbarium abbreviation is absent in front of a specimen number.

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INTRODUCTION[1]

Most fungi are saprophytes living on the dead remains of plants and animals and consequently they are the principal agents of decay in nature. The decomposition of fallen trees, stumps, branches, and leaves prevents the accumulation of these in the forests and improves the soil. The same processes may decay useful timber and produce great economic losses. Timber attacked by fungi may be so altered in its properties that it becomes useless for construction purposes.

The Basidiomycetes are very important wood-destroying organisms. In this class the members of the family Thelephoraceae are common on wood, and of these the species in the genus Peniophora form a large and significant group.

TAXONOMY AND NOMENCLATURE

The genus Peniophora in the family Thelephoraceae was established by M. C. Cooke (Cooke, 1879). It was segregated out of the genus Corticium on the basis of sterile structures in the hymenium that Cooke designated as "metuloids" and that later workers have called cystidia. Unfortunately, both genera, Corticium and Peniophora, were based on the same species, *Thelephora quercina* Pers. ex Fries. Peniophora of Cooke is a synonym of the genus Corticium, and the latter name, rightly applied, refers to the species now relegated to Peniophora. The name Peniophora, however, has had consistent usage by mycologists for over seventy years, and replacement of this name would create great confusion.

The identification of species in the early history of mycology made use of only macroscopic characters. Cooke, when he created a genus on the basis of a microscopic structure, enforced the use of microscopic techniques in the study of Hymenomycetes. The first student to consistently use microscopic techniques in the taxonomy of Hymenomycetes was Bresadola. By study of types he established the identity of a great many old species; and by the identification of material from throughout the world he greatly enlarged and corrected distribution data. His work was a model of taxonomic research, typified by extensive and exact microscopic study, with the deposition of study notes with all specimens examined, and by extensive ex-

[1] A thesis presented to the State University of New York College of Forestry, Syracuse, in partial completion of the requirements for the degree of Doctor of Philosophy, June 1959.

change of identified specimens with mycologists throughout the world. His methods were followed by many European mycologists, especially by Bourdot and Galzin, who have written the only manual for European species of Peniophora. This manual contains accurate descriptions, a subdivision of the genus into well-defined groups, and good illustrations.

The genus Peniophora was monographed in America by Burt in 1926. His notable work contained descriptions of over a hundred species, many proposed as new. Burt's work was continued in critical studies by Jackson (1948, 1949, 1950) and his students (McKeen, 1952; Weresub, 1953, 1957), and by Rogers (Rogers and Jackson, 1943).

Recent study in the genus Peniophora follows two general lines of approach. Representative students of the first school, the more conservative one, recognize the heterogeneity of the genus, but retain the old generic concept, at least for the present, and restrict their study to species or groups of species. The representatives of the other, less conservative school (*e.g.,* Donk, Eriksson), have searched for natural relationships among different groups of Hymenomycetes and, on the basis of applicable criteria, they are attempting to create a more natural classification, partly by more strictly defined generic concepts. A more extensive knowledge of the taxonomy of the resupinate Thelephoraceae and of other Hymenomycetes, supplemented by cultural and cytological work, seems necessary for a better understanding and rearrangement of the species involved. In recognition of these problems the genus Peniophora is treated here in the original sense of Burt and of Bourdot and Galzin.

Peniophora is an artificial genus composed of groups of species of corticioid fungi, and of many species with unrecognized relationships. Some of these groups appear to be natural, *e.g.,* the *P. rimicola* group in Section II of this manual; some others appear to be related to other genera of Hymenomycetes. The most similar genus is Corticium, and an unknown specimen would be placed in that genus if the cystidia were overlooked, as their presence or absence is the only character that separates these two genera. Forms transitional with other genera of Hymenomycetes include *P. livida,* which could be placed in the genus Phlebia due to its texture and basidia, *P. aspera,* which has the hymenial configuration of a species of Odontia, and *P. phlebioides,* which, because of its folded hymenium, resembles a species of Merulius. Other examples are cited in the species descriptions.

Additional data on the taxonomy and intergeneric relationships of the genus Peniophora are given by Eriksson (1950, 1958) and Weresub (1957).

BIOLOGIC AND ECONOMIC IMPORTANCE

The members of the genus Peniophora are extremely common, fruiting on wood debris of all sizes, particularly on slash. Although their fruiting bodies are inconspicuous and their decay apparently limited, their abundance and frequency and their ability to fruit under relatively dry conditions may indicate that they play a considerable role in the decomposition of slash.

The extent of decay in nature as well as in forest products by species of Peniophora has been very little investigated. Only an extremely limited literature is available, perhaps because of the taxonomic difficulties involved.

Baxter (1952, pp. 321, 493, 517) and Boyce (1948, p. 402) report that *P. gigantea* causes saprot of both gymnosperm and angiosperm pulpwood in storage, and of wood products. Hornibrook (1950) found that *P. luna* Rom. causes a brown rot in lodgepole pine. Nobles (1956) reports the association of *P. septentrionalis* Laurila with decay in spruce in Canada. Cowling (1957), in a list of fungi associated with decay of wood products, reports that *P. pubera* occurs on building material.

MATERIALS AND METHODS

The descriptions are based on herbarium material (about 700 specimens, from the herbaria listed in the acknowledgments) and on my own collections (about 500 specimens, deposited in the herbaria of the State University College of Forestry at Syracuse, New York, and of the New York State Museum, Albany, New York). All specimens collected in New York and filed under Peniophora in the herbaria of the department of Plant Pathology at Cornell University, New York State Museum, and the New York Botanical Garden, were studied and study notes were deposited with each specimen.

Field notes were taken on my own collections, particularly of color and texture. Deposition of a spore print was attempted from those in good fruiting condition by wrapping a specimen in cellophane with a glass slide against the hymenial surface. The specimen is then placed with the hymenium on the lower side and left for twelve or more hours. All spore prints secured were white or creamy white.

Macroscopic details of specimens were studied with a stereoscopic microscope at $\times$ 17. For microscopic study a vertical section of the fertile fruiting body was essential. Crushed sections were useful for

detailed study of particular structures. Two sections were necessary. One was mounted in Meltzer's solution to determine if an amyloid reaction occurred. This was indicated by a more or less blue color in the reacting structure. The other section was mounted in 3 per cent KOH solution and mixed with a saturated aqueous solution of phloxine. Where necessary, a cell-wall stain, Congo red in 70 per cent alcohol, was added to the KOH-phloxine mount. Ten per cent KOH can be added to the same mount to test the persistence of the cystidial walls. Gloeocystidia were usually distinguishable in the KOH-phloxine mount. In hard, waxy specimens, members of the section *Coloratae* of Bourdot and Galzin, gloeocystidia are difficult if not impossible to distinguish. For these sulfuric benzaldehyde reagent was used as introduced for studies in the Thelephoraceae by Boidin (1951); in this medium the gloeocystidia appear violaceous black.

The formulae of Meltzer's solution and sulfuric benzaldehyde are:

Meltzer's solution (from Weresub, 1953)

Iodine	0.5 gm
Potassium iodide	1.5 gm
Chloral hydrate	20.0 gm
Water	20.0 cc

Sulfuric benzaldehyde (from Boidin, 1951)

Water	1.5 cc
Pure sulfuric acid	5.0 cc
Benzaldehyde	4.5 cc

Sulfuric acid is first added to the water and, after cooling, the benzaldehyde is added. Because of the violent reaction of concentrated sulfuric acid with water the preparation of this reagent should be done with caution.

DISTRIBUTION AND SUBSTRATUM

Members of the genus Peniophora have a world-wide distribution. Many species, however, are restricted to certain climatic or geographic regions. The distribution of a species is known usually from intensive collecting in often far separated areas. Extraordinary distribution records (*e.g., P. phlebioides* from New York and British Columbia) more likely indicate a lack of collecting effort in the intervening area, rather than a truly limited distribution.

Most species of Peniophora are found on dead wood of rather small diameter that is usually covered with bark. Other substrata include leaves, conifer needles and cones, fungal tissue, mosses, liverworts, and soil. As a rule each species shows a preference for a certain

type of substratum but may not be strictly limited to it. *P. populnea* is a decided exception, as it has been collected only on the wood of *Populus tremuloides* Michx.

MORPHOLOGY OF THE FRUITING BODY

The fruiting body of species of Peniophora generally follows the surface of the substratum and rarely exceeds one millimeter in thickness. Usually the fruiting body is isolated and exhibits a radial or rarely a longitudinal pattern of growth. Some, however, originating at lenticels, may remain for some time as discrete patches and coalesce with age. The extent of the fruiting body depends on a great many factors, and only a very general description can be indicated by the terms "somewhat . . ." or "widely effused."

Species of Peniophora range in color from white to almost black. The color is so variable that little value can be attached to it for identification. In certain species, however, the color is important or at least helpful diagnostically, as in *P. viticola* and *P. incarnata*.

The hymenium and margin make up the external tissue of the fructification. The surface modifications of the hymenium depend on the arrangement of the basidia, and on the presence, size, and position of the sterile organs in the hymenium. The margin may be thinned out or it may be more or less distinctly delimited. The marginal tissue may be continuous with that of the fructification itself or show a different arrangement. Often it is radiately fibrillose, extending sometimes to form mycelial strands which may then be diagnostically important as in *P. filamentosa* or *P. burtii*. The fruiting bodies may adhere closely to the substratum, *i.e.,* are adnate, or they may be readily removed, *i.e.,* are separable.

The color of the context as it appears in the section depends on the color of the hyphae, but its intensity depends largely on the thickness of the section. As the majority of the species are composed of colorless hyphae, most sections appear hyaline or somewhat creamy. A small proportion of species possessing slightly colored hyphae appear yellowish, brownish, or pinkish. Sometimes two or more or less distinct layers may be recognized in vertical sections. Layering depends on a differential color of the hyphae or on their arrangement, or on an uneven distribution of crystals in the fruiting body. Layering may have some diagnostic significance.

Texture is a property dependent on the arrangement of the components making up the fruiting body and on their chemical composition. To establish the nature of the texture a macroscopic examination should be supplemented with the study of a vertical section.

The following general types of texture were recognized, following Talbot (1954):

Floccose. The hymenium does not form a continuous palisade layer. It is interrupted and is often at different levels. The fruiting body appears as a cottony mass of hyphae. See Plate I, A.

Pelliculose. The hymenial layer is compact and sharply differentiated from the loosely arranged subhymenium and context. Macroscopically the fruiting body appears like a thin crust resting on a soft, cottony matrix. See Plate I, B.

Membranous. There is no distinct differentiation between hymenium, subhymenium, and the context. All are more or less compactly arranged. See Plate I, C.

Waxy. The section appears very compact and its components are almost indistinguishable. The fruiting body becomes hard and dry with age. See Plate I, D.

For additional details on texture see Talbot as above. The recognition of texture is important diagnostically and is necessary for separation of a number of species in my key.

The microscopic structures are critical for identification. Those used in this study are discussed below:

Hyphae. Nearly all species of Peniophora are composed of only one type of hyphae, that is, the species are monomitic. These hyphae are generally thin-walled and more or less abundantly branched. Only one species, *P. greschikii,* is composed of two distinct types of hyphae, namely, it is dimitic. In addition to the usual type it possesses also thick-walled to semisolid, rarely branching hyphae. In the majority of species the hyphae are unincrusted. In some they are covered with crystals which may be minute and evenly distributed, or they may be of a larger diameter and unevenly scattered over the surface of the hyphae. The designations "thin-. . .", "rather thin-. . .", "rather thick-. . .", and "thick-walled" depends on the ratio between the thickness of the wall and the diameter of the hyphae (*e.g.,* a hypha 5 μ in diameter having walls up to 0.5 μ thick is considered as being thin-walled; a hypha of this diameter is considered thick-walled if the walls reach a thickness of 1–1.5 μ. The hyphae of all species of Peniophora are either simple-septate (Fig. 10) or nodose-septate (Fig. 9).

The hyphal arrangement varies with the species. In some it may be parallel to the substratum and turn away to become vertical;

or it may be more or less ascending from the substratum; or in some other species it is irregularly arranged. The septation of the hyphae, and in a few species the incrustation, branching, and cell length are of primary importance for identification purposes.

Cystidia. These are sterile, colorless, specialized terminal cells of hyphae, usually originating in the hymenium, and lacking contents. Their presence is of generic significance, separating Peniophora from Corticium. Their size and shape are very variable among the species (Figs. 23, 48, 74, 77) but within a species they remain fairly constant. Consequently, the cystidia are diagnostic characters at the specific level. As a rule the cystidia project above the hymenial surface and with some experience often can be detected macroscopically. The line crossing the cystidium in certain figures (*e.g.*, Figs. 4, 50, 56) represents the hymenial level above which the cystidium projects. Cystidia may be thin- (Fig. 81) or thick-walled (Fig. 3), incrusted (Fig. 52) or not (Fig. 54), septate (Fig. 38) or nonseptate (Fig. 53). Their walls may persist or dissolve in 10 per cent KOH.

Cystidioles (Figs. 6, 7, 8). These are slightly differentiated hyphal tips scattered among the basidia. They rarely exceed the basidia in diameter, but may be considerably longer.

Gloeocystidia (Figs. 16, 18, 20). These are thin-walled, unincrusted, flexuous sterile organs lacking the rigidity of cystidia. Gloeocystidia usually can be seen in the ordinary mounting media. They originate deep in the context and remain imbedded. Gloeocystidia of actively growing fruiting bodies contain granular or oily material and appear slightly colored. Young unincrusted cystidia may be mistaken for gloeocystidia, and caution should be exercised in their identification. Gloeocystidia of hard and waxy specimens may be indistinguishable in ordinary mounting media. They can be positively demonstrated by using sulfuric benzaldehyde reagent. The presence of gloeocystidia has been used for the separation of Section III in this manual, and their size is important in the determination of a few species.

Basidia (Plate I, E b). These are terminal, nonseptate sexual cells of hyphae in the hymenium, usually with four sterigmata. Their size and shape may be of diagnostic importance.

Spores. The examination of spores still attached to the sterigmata (Plate I, E s) is very useful because it excludes the possibility of studying spores of some contaminant. Spore size and shape are

considered to be dependable specific characters. The amyloidity of spores also is considered of primary importance and Section I of this manual is separated on the basis of this character. With rare exceptions spores are hyaline, thin-walled, with walls smooth or sometimes ornamented.

For additional details on the morphology of the fruiting body see Overholts (1929) and Lentz (1954).

SUMMARY

This manual contains descriptions and illustrations of and keys to species of Peniophora known or suspected to occur in New York State or adjacent regions. Notes on distribution and on the correlated literature are included from all available sources.

In all 91 species are described; one new combination is proposed, *Corticium subseriale* Bourd. & Galz. to *Peniophora subserialis;* no new synonyms are suggested.

The following species represent the first record for New York: *P. abietis, P. calothrix, P. chaetophora, P. erikssonii, P. hastata, P. phlebioides, P. propinqua,* and *P. subserialis.*

ACKNOWLEDGMENTS

This work was made possible because identified specimens of most of the species were provided by Dr. Roy F. Cain of University of Toronto. He and Dr. Luella K. Weresub, now at the Department of Agriculture, Ottawa, identified the specimens or confirmed the determinations of many of my collections. In addition, both demonstrated the methods of research used in this work, and assisted in many other ways. I am indebted to Dr. Donald P. Rogers of the University of Illinois for a critical reading of the manuscript. Acknowledgments are made to the New York State Museum and Science Service for Graduate Student Honoraria which made possible the collection of material during two summers. The following institutions[1] loaned specimens and permitted use of their herbarium facilities: Department of Plant Pathology, Cornell University, Ithaca, New York (CUP); Farlow Library and Herbarium of Cryptogamic Botany, Harvard University, Cambridge, Massachusetts (FH); The New York Botanical Garden, Bronx Park, New York, New York (NY); New York State Museum, Albany, New York (NYS); Na-

[1] Herbarium abbreviations are those of the Index Herbariorum, by J. Lanjouw and F. A. Stafleu, Utrecht, 1952. The herbarium of the State University College of Forestry, Syracuse, N. Y., is designated SYR-F.

tional Fungus Collections, U. S. Department of Agriculture, Beltsville, Maryland (BPI); Department of Botany, Pennsylvania State University, University Park, Pennsylvania (PAC); and the Department of Botany, University of Toronto, Toronto, Ontario, Canada (TRT).

The work was done under the direction of Dr. Josiah L. Lowe, to whom gratitude is expressed for his assistance, encouragement, and criticism.

PENIOPHORA Cooke
Grevillea 8:20. 1879

Fructifications resupinate, effused, of various colors and textures, occasionally without a distinct subiculum; hymenial surface continuous or sometimes discontinuous, often cracked when dry, even (or very rarely folding, hydnoid, papillose or rugulose); margin adnate or in two species curling away from the substratum.

In section hyaline or colored, homogeneous or rarely of two layers; hyphae occasionally incrusted, thin- to thick-walled, simple- or nodose-septate; cystidia thin- or thick-walled, the wall persisting or dissolving in 10 per cent KOH solution, usually incrusted, immersed or more often projecting; cystidioles rarely present; gloeocystidia present or absent; basidia nonseptate, usually with four sterigmata; spores hyaline or rarely tinted, smooth or ornamented, amyloid or nonamyloid, mostly thin-walled, of various shapes.

Type species: *Thelephora quercina* Pers. ex Fries

KEY TO THE SECTIONS

1. Spores amyloid ..... Section I, page 17
1. Spores nonamyloid, the wall ornamented .... Section II, page 21
1. Spores nonamyloid, the wall smooth except in 48. *P. abietis* .. 2
   2. Gloeocystidia present ..... Section III, page 24
   2. Gloeocystidia absent 3
3. Cystidia dissolving in 10% KOH, with a capillary lumen, distinctly broadened or rooted at the base except in 22. *P. crassa* .... Section IV, page 35
3. Cystidia not dissolving in 10% KOH, lumen wider, not distinctly broadened and not rooted at the base 4
   4. Cystidia typically septate ..... Section V, page 46
   4. Cystidia typically nonseptate 5
5. Spores subglobose to globose ..... Section VI, page 52
5. Spores cylindrical to ellipsoid 6
   6. Hyphae typically simple-septate, with occasional clamp connections at some septa ..... Section VII, page 58
   6. Hyphae strictly nodose-septate, with clamp connection at every septum .... Section VIII, page 71

Section I

Spores amyloid, the wall smooth or ornamented; cystidia thin- or thick-walled, slightly to heavily incrusted, sometimes septate and with or without clamp connections at the septa, hyaline (or colored in one species); gloeocystidia sometimes present; hyphae simple- or nodose-septate.

All species whose spores turn more or less blue in Meltzer's solution are included in this section. Two species with ornamented spores and gloeocystidia, and two others with septate cystidia, might be placed by mistake in Sections II, III or V if the reaction with Meltzer's solution were not observed.

The amyloid nature of the spore is considered to be a very dependable character for grouping species in this genus. The amyloid reaction is an expedient character to use for the species included here; it brings together, however, species of widely varying morphology, and its phylogenic significance needs further testing.

KEY TO THE SPECIES

1. Gloeocystidia present; spore wall usually ornamented.....2
1. Gloeocystidia absent; spore wall smooth.....3
   2. Hyphae simple-septate.....1. *P. convolvens*
   2. Hyphae nodose-septate.....2. *P. heterogenea*
3. Cystidia very abundant, thick-walled, brownish, heavily incrusted .....3. *P. laevigata*
3. Cystidia rare to frequent, thin-walled, hyaline, not at all or only slightly incrusted.....4
   4. Spores cylindrical, 6–8 × 1.5–2 μ .....4. *P. subsulphurea*
   4. Spores ellipsoid, 4–5.5 × 2–2.5 μ .....5. *P. subincarnata*

1. *Peniophora convolvens* (Karst.) Hoehn. & Litsch. Fig. 1

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1551. 1906. *Corticium convolvens* Karst., Finl. Nat. Folk. Bidr. 48:424. 1889.

Fructifications somewhat effused, more or less adnate, yellowish-tan, membranous; surface pruinose; margin radiately fibrillose, sometimes forming mycelial strands.

In section slightly colored, 150–350 μ thick; hyphae thin- to rather thick-walled, simple-septate, 3–5 μ in diameter; cystidia rare to abundant, conical, thick-walled, heavily incrusted, immersed or projecting up to 40 μ, 30–60 × 9–15 μ; gloeocystidia numerous, usually cylindrical, flexuous, 60–200 × 9–14 μ; basidia clavate, 20–30 × 5–7

μ; spores hyaline, echinulate, amyloid, broadly ellipsoid, prominently apiculate, 5.5–7 × 3–4.5 μ.

On wood of angiosperms in Georgia and Panama; not yet known from New York but reported from a similar vegetation zone in Tennessee, North Carolina, Finland, and Sweden.

The diagnostic characteristics of this species are the prominently echinulate and amyloid spores, the simple-septate hyphae, and the conical cystidia.

2. *Peniophora heterogenea* Bourd. & Galz. Fig. 2
Soc. Myc. France Bul. 28:393. 1913.

Fructifications somewhat effused, separable, white to cream, pelliculose, fragile; surface even, farinose; margin indeterminate, or "bordure aranéeuse, avec filaments rhizoïdes, épais, rameux ou flabellés" (Bourdot and Galzin, 1928, p. 314).

In section hyaline, 100–200 μ thick; hyphae loosely arranged, thin-walled, nodose-septate, 2–3 μ in diameter; cystidia scattered, narrowly clavate, rather thick-walled, moderately incrusted, projecting up to 40 μ, 60–100 × 5–7 μ; gloeocystidia numerous, immersed, slightly colored, fusiform, 50–90 × 6–7 μ; basidia clavate, 15–20 × 4–6 μ; spores hyaline, smooth to minutely echinulate, amyloid, broadly ellipsoid to oval, 4–5 × 2.5–3.5 μ.

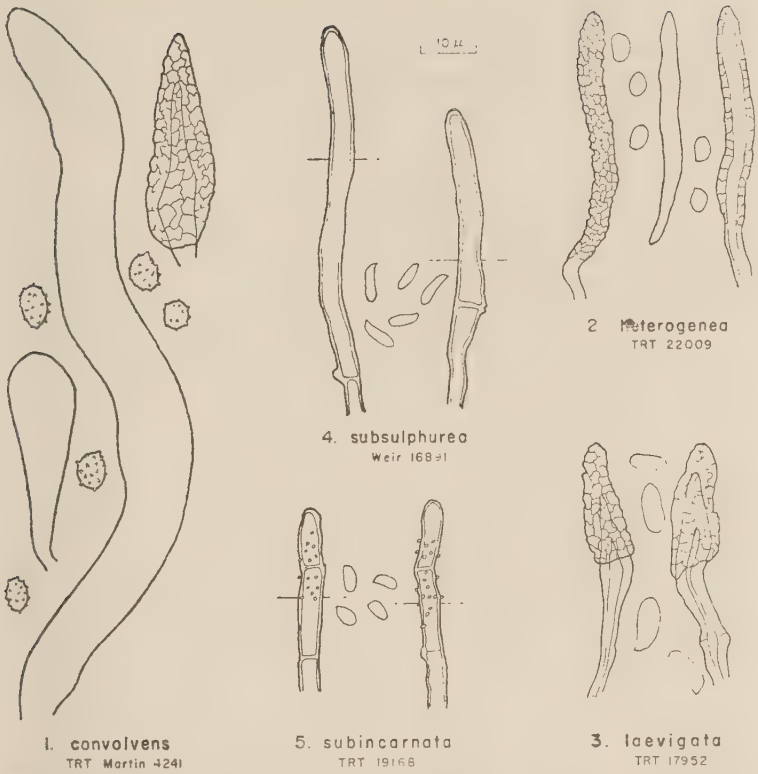
On wood of angiosperms and gymnosperms in Ontario, Austria, and France; not yet known from New York; reported from Sweden.

The distinctive characteristics of this species are its pelliculose texture in combination with its clavate cystidia.

3. *Peniophora laevigata* (Fries) Massee Fig. 3
Linn. Soc. Jour. Bot. 25:149. 1889. *Thelephora laevigata* Fries, Elench. Fung. 1:224. 1828.

Fructifications widely effused, adnate, cinnamon-brown or rarely pale gray with a pinkish tint, membranous; surface minutely pilose, deeply cracking; margin concolorous, sometimes rolling away from the substratum on drying.

In section more or less brown, 150–400 μ thick; hyphae loosely arranged next to the substratum, becoming compact and indistinct toward the hymenium, slightly colored, thin- to rather thin-walled, nodose-septate, constricted at the septa, 3–5 μ in diameter; cystidia very abundant throughout, olive-brown to golden-brown, usually fusiform, thick-walled, heavily incrusted, projecting up to 25 μ, 30–75 (or "–150", Bourdot and Galzin, 1928, p. 326) × 5–9 μ; basidia



FIGS. 1-5. — Microscopic features of species of Peniophora, all × 750. FIG. 1. Cystidium, gloeocystidia, and spores of *P. convolvens*. FIG. 2. Same of *P. heterogenea*. FIG. 3. Cystidia and spores of *P. laevigata*. FIG. 4. Same of *P. subsulphurea*. FIG. 5. Same of *P. subincarnata*. The specimen from which the drawing was made is indicated for each figure.

narrowly clavate, 25–35 × 3.5–4.5 μ; spores hyaline, smooth, amyloid, cylindrical to ellipsoid, 7–10.5 × 3–5 μ.

On gymnosperms in New York, Ontario, Germany, and Yugoslavia; reported from England, Sweden, Finland, and Italy.

The brown incrusted cystidia combined with the amyloid spores distinguish this species. Bourdot and Galzin (1928, p. 326) noted that its microscopic structure is similar to that of *Stereum areolatum* Fries and *S. chailletii* (Pers.) Fries.

4. *Peniophora subsulphurea* (Karst.) Hoehn. & Litsch. Fig. 4

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1561. 1906. *Corticium subsulphureum* Karst., Soc. Faun. Fl. Fenn. Medd. 6:12. 1881.

Fructifications somewhat effused, separable, yellowish, subpelliculose; surface interrupted, pruinose; margin thinning out.

In section hyaline, 100–200 μ thick; hyphae loosely arranged next to the substratum, becoming compact and somewhat incrusted near the hymenium, rather thin-walled, nodose-septate, 3–5 μ in diameter; cystidia few, cylindrical, flexuous, thin-walled, sometimes slightly incrusted, occasionally septate, with or without clamp connections, projecting up to 30 μ, 60–100 × 5–6 μ; basidia clavate, 15–25 × 4–5 μ; spores hyaline, smooth, amyloid, cylindrical, slightly curved, 6–8 × 1.5–2 μ.

On wood of gymnosperms in Idaho, British Columbia, France, and Finland; not yet known from New York; reported from Austria.

Although not known from eastern North America, the species is included because it is often confused with 5. *P. subincarnata*. The two species are easily separable by their spores which, in *P. subincarnata*, are ellipsoid, 4–5.5 × 2–2.5 μ. For extensive observations on these species see Rogers and Jackson (1943, p. 303).

5. *Peniophora subincarnata* (Peck) Litsch. Fig. 5

Oesterr. Bot. Zeitschr. 88:117. 1939. *Corticium subincarnatum* Peck, N. Y. State Mus. Rept. 42:124 [or 28]. 1889.

Fructifications widely effused, separable, yellow to cinnamon-yellow, subpelliculose; surface pulverulent or minutely pilose, often cracking; margin paler, radiately fibrillose.

In section hyaline below, pale yellowish in the hymenium, 200–300 μ thick; hyphae loosely arranged next to the substratum, becoming erect, compact, rough-walled or somewhat incrusted in the subhymenium, rather thin-walled, nodose-septate, 3–4.5 μ in diameter; cystidia frequent, cylindrical, often appearing flexuous, sometimes slightly incrusted, occasionally septate with or without clamp connections, projecting up to 40 μ, 50–80 × 4–6 μ; basidia narrowly clavate, 20–30 × 4–6 μ; spores hyaline, smooth, amyloid, ellipsoid, flattened on one side, 4–5.5 × 2–2.5 μ.

On wood of gymnosperms in New York, Ontario, Idaho, Washington, and Austria.

No. 4. *P. subsulphurea* is very similar except for its spores, which are cylindrical, 6–8 × 1.5–2 μ.

Section II

Spores nonamyloid, the spore wall ornamented and the ornamentation persisting or disappearing in KOH; cystidia thin-walled, not incrusted; cystidioles cylindrical or capitate, lobed in one species; basidia with sterigmata varying from two to seven; hyphae nodose-septate.

Macroscopically the species are characterized by a gelatinous fruiting body which dries to a thin, hard, bluish film, and by "the development of cordlike strands which ramify over the surface of the fructification or appear at the margin" (Jackson, 1950, p. 526). The fruiting bodies are inconspicuous and easily overlooked.

Treatment of the species of this section necessarily follows Jackson's work (1950, pp. 525-534). Fresh specimens have to be studied for satisfactory understanding of this group. Dried specimens identified by Jackson form the basis for the descriptions, as I have not collected these species.

Meltzer's solution is indispensable in establishing the nonamyloid nature of the spores and their ornamentation.

P. pulverulenta (Litsch.) Jacks. could be considered here as it agrees in all characters of this section except the lack of cystidia. According to the concept used in this paper the species must be relegated to the genus Corticium.

KEY TO THE SPECIES

1. Spore ornamentation persisting in KOH.....6. *P. praeterita*
1. Spore ornamentation disappearing in KOH.....2
   2. Spores 8.5–10 × 4.5–7 μ; cystidioles capitate.....7. *P. rimicola*
   2. Spores 5–7.5 × 3–4.5 μ; cystidioles lobed.....8. *P. pruinosa*

6. *Peniophora praeterita* Jacks. Fig. 6
   Canad. Jour. Res. 28(C):533. 1950.

Fructifications somewhat effused, adnate, bluish-gray, gelatinous; surface pruinose; margin indeterminate.

In section hyaline, about 20–30 μ thick; hyphae longitudinally arranged, compact, strongly coherent, gelatinized, thin-walled, nodose-septate, 1.5–2 μ in diameter; cystidia abundant, subcylindrical, flexuous, thin-walled, not incrusted, projecting for almost their entire length, 60–70 × 6–8 μ; cystidioles few, cylindrical or capitate, 15–20 × 3–5 μ; basidia subclavate, 20–25 × 6–8 μ; spores hyaline, echinulate, nonamyloid, broadly ellipsoid to subglobose, prominently apiculate, 7.5–9 × 6–7.5 μ.

On wood of angiosperms in Ontario; not yet known from New York; reported from Connecticut.

The distinctive characteristic of this species, in contrast with 7. *P. rimicola* and 8. *P. pruinosa,* is the persistence of the spore markings in KOH.

7. *Peniophora rimicola* (Karst.) Hoehn. & Litsch. Fig. 7

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115: (Abt. 1):1556. 1906. *Corticium rimicolum* Karst., Hedwigia 35:45. 1896.

Fructifications widely effused, adnate, dark bluish-gray to gray, gelatinous; surface pruinose; margin indeterminate.

In section hyaline, up to 50 μ thick; hyphae longitudinally arranged next to the substratum, then ascending, compact, gelatinized, thin-walled, nodose-septate, 1.5–2.5 μ in diameter; cystidia numerous, cylindrical or somewhat subulate, walls thin, becoming thickened in the lower half, not incrusted, projecting for almost their entire length, 70–100 × 10–15 μ; cystidioles usually capitate, 25–30 × 2.5–3.5 μ; basidia subclavate, 18–24 × 7–8 μ; spores hyaline, smooth in KOH but appearing minutely echinulate in Meltzer's solution, nonamyloid, broadly ellipsoid to subglobose, flattened on one side, prominently apiculate, 8.5–10 × 4.5–7 μ.

On wood of angiosperms in Ontario and Finland; not yet known from New York; reported from Missouri, Oregon, Washington, British Columbia, Brazil, and South Africa.

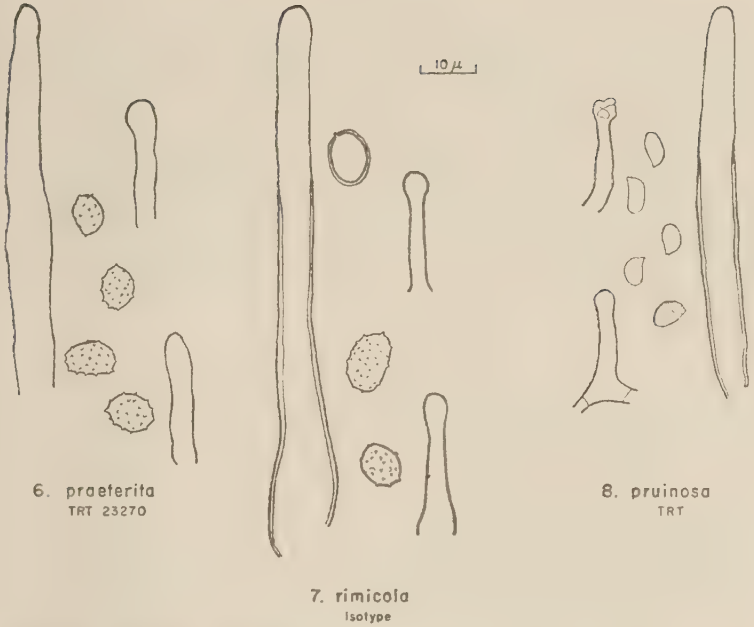
This species is very similar to 8. *P. pruinosa* which differs mainly in its smaller spores, 5–7.5 × 3–4.5 μ, and lobed cystidioles.

8. *Peniophora pruinosa* (Pat.) Jacks. Fig. 8

Canad. Jour. Res. 28(C):530. 1950. *Corticium pruinosum* Pat., Cat. Rais. Pl. Cell. Tunisie, p. 60. 1897. *P. chordalis* Hoehn. & Litsch. (*fide* Jackson, 1950, p. 530).

Fructifications somewhat effused, adnate, bluish-gray, gelatinous; surface pruinose; margin indeterminate.

In section hyaline, 30–45 μ thick; hyphae compact and indistinct, often gelatinized, rather thin-walled, nodose-septate, 2–3 μ in diameter; cystidia few, cylindrical, often slightly tapering, with walls gradually thinning out, not incrusted, projecting for almost their entire length, 60–100 × 4–7 μ; cystidioles not observed, or "cystidioles cylindric or tapering gradually from base to apex, 25–45 (–60) × 2.5–3.5 μ, wall slightly thickened below, apex occasionally simple or capitate when young, more commonly with three to five short blunt



FIGS. 6-8. — Microscopic features of species of Peniophora, all × 750. FIG. 6. Cystidium, cystidioles, and spores of *P. praeterita*. FIG. 7. Same of *P. rimicola*, drawn from isotype (in FH). FIG. 8. Same of *P. pruinosa*. Cystidium and spores drawn from Jackson coll., July 8, 1937 (in TRT), and cystidioles redrawn from Jackson, 1950, p. 528.

lobes" (Jackson, 1950, p. 530); basidia subclavate, 18–24 × 6–8 μ; spores hyaline, smooth in KOH, rough in Meltzer's solution, non-amyloid, ellipsoid, flattened on one side, 5–7.5 × 3–4.5 μ.

On wood of angiosperms in New York and Tunisia; reported from Austria, France, Brazil, and South Africa.

No. 7. *P. rimicola* differs in its larger spores, 8.5–10 × 4.5–7 μ, and in having capitate, never lobed cystidioles. Jackson observes that cystidioles "are extremely scarce in some collections." They were not found in the specimens available for this study. No. 6. *P. praeterita* is very similar but its spore markings persist in KOH; it differs also in having larger spores, 7.5–9 × 6–7.5 μ.

Section III

Gloeocystidia present; spores nonamyloid, the wall smooth; cystidia usually thick-walled and eventually heavily incrusted, or thin-walled and unincrusted, of distinctly variable shape in one species; hyphae hyaline or brown, simple- or nodose-septate.

The presence of gloeocystidia is the diagnostic character of this section. As a rule, they can be detected in the usual mounting solutions. In five species, members of the Section *Coloratae* of Bourdot and Galzin, sulfuric benzaldehyde may be effectively employed. The fructifications in the majority of the species have a more or less distinct color and waxy consistency.

KEY TO THE SPECIES

1. Spores (10–)11–18 μ long 2
1. Spores (5–)7–11 μ long 7
   2. Spores 6–11 μ in diameter 3
   2. Spores 3–5 μ in diameter 4
3. Hyphae nodose-septate ..... 9. *P. aurantiaca*
3. Hyphae simple-septate ..... 10. *P. erikssonii*
   4. Spores cylindric-ellipsoid, length to width ratio 1:2–2.5; gloeocystidia 12–18 μ in diameter ..... 11. *P. subalba*
   4. Spores cylindrical, length to width ratio 1:3–3.5; gloecystidia 4–12(–14) μ in diameter 5
5. Fruiting body cream, in section hyaline, 300–1000 μ thick ..... 12. *P. mutata*
5. Fruiting body dark colored, in section brownish, 200–400 μ thick 6
   6. In section homogeneous, chestnut-brown; on Populus ..... 13. *P. populnea*
   6. In section two-layered, upper layer brown, the lower hyaline; on other angiosperms ..... 14. *P. heterocystidia*
7. Hyphae brown; in section distinctly brown 8
7. Hyphae hyaline; in section light colored 9
   8. Gloeocystidia usually rare, 7–10 μ in diameter ..... 15. *P. violaceo-livida*
   8. Gloeocystidia usually abundant, 10–20 μ in diameter ..... 16. *P. nuda*
9. Sulfuric benzaldehyde positive; fruiting body orange or pinkish-buff 10
9. Sulfuric benzaldehyde negative; fruiting body white to cream 11

10. Fruiting body orange; spores 7–10 × 2.5–4 μ ..... 17. *P. incarnata*
10. Fruiting body pinkish-buff; margin often curling away from the substratum; spores 5–7.5 × 2–2.5 μ ..... 18 *P. duplex*
11. Cystidia thin-walled, variable, unincrusted ..... 19. *P. tenuis*
11. Cystidia thick-walled, of uniform shape, heavily incrusted 12
12. Growing on species of Typha ..... 20. *P. typhicola*
12. Growing on wood ..... 21. *P. pubera*

9. *Peniophora aurantiaca* (Bres.) Hoehn. & Litsch. Fig. 9

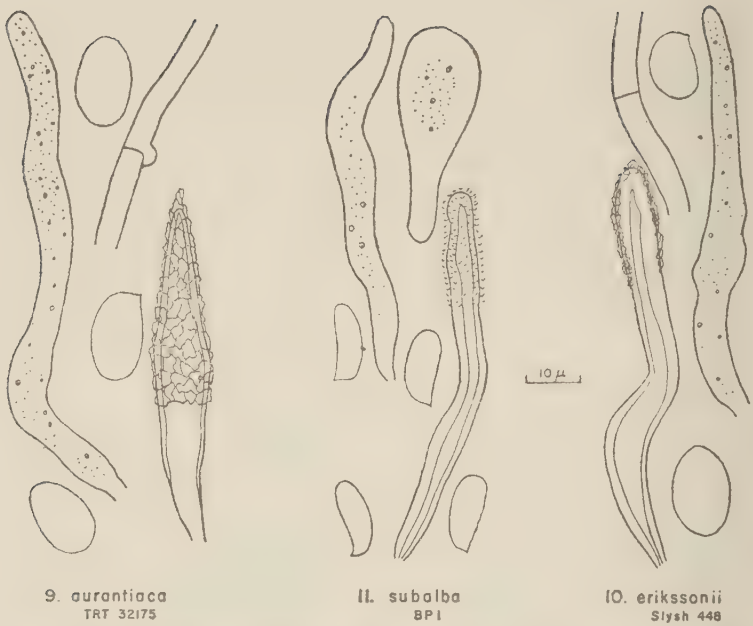
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1583. 1906. *Corticium aurantiacum* Bres., Fung. Trid. 2:37. 1892. *P. lepida* Bres. (*fide* Rogers and Jackson, 1943, p. 270).

Fructifications arising at lenticels and forming small patches, then confluent, adnate, orange to "light pinkish-cinnamon" (Burt, 1926a, p. 311), soft-membranous when young, when mature crustose, firm; surface interrupted when young, becoming continuous, finely pilose; margin white, minutely fibrillose.

In section hyaline, 100–300 μ thick; hyphae arranged parallel to the substratum and forming a basal layer, then ascending, compact, thin-walled, nodose-septate, 3–5 μ or "3–6 (–11) μ" (Bourdot and Galzin, 1928, p. 320) in diameter; cystidia usually abundant, sometimes scarce in certain specimens or unevenly distributed in parts of the same specimen, subcylindrical to conical, becoming heavily incrusted, usually immersed, 50–70 × 7–10 μ; gloeocystidia numerous, cylindrical, flexuous, attenuate or obtuse, sometimes projecting up to 20 μ, 70–100 × 10–15 μ; basidia large, clavate or subclavate, 40–60 × 8–12 μ or "54–95 × 11–15 μ" (Bourdot and Galzin, 1928, p. 320); spores hyaline, smooth, nonamyloid, ellipsoid, apiculate, 12–18 × 6–11 μ.

On Alnus in New York, Ontario, Idaho, Italy, Germany, and Czechoslovakia; reported as widespread from the temperate and boreal zone of North America and Europe.

The color, habit of growth, and specialized substratum help in identification. In this manual only 10. *P. erikssonii* has equally large spores; it differs in having simple-septate hyphae. No. 17. *P. incarnata* is similar externally, and differs mainly in its smaller spores, 7–10 × 2.5–4 μ.



Figs. 9-11. — Microscopic features of species of Peniophora, all × 750. Fig. 9. Cystidium, gloeocystidium, spores, and hypha of *P. aurantiaca*. Fig. 10. Same of *P. erikssonii*. Fig. 11. Cystidium, gloeocystidia, and spores of *P. subalba*. Cystidium drawn from Stevenson coll., Sept. 3, 1947 (in BPI), gloeocystidia and spores drawn from Spaulding coll. (F.P. 81346 in BPI).

10. *Peniophora erikssonii* Boidin Fig. 10
Soc. d'Hist. Nat. Toulouse Bul. 92:286. 1958 (as *P. erikssoni*).

Fructifications arising at the lenticels, forming small patches, then confluent, adnate, light pinkish-buff, crustose in mature specimens but soft membranous when young; surface even (or interrupted when young), finely pilose; margin white, minutely fibrillose.

In section hyaline, 100–300 μ thick; hyphae parallel next to the substratum, forming a distinct basal layer, then ascending, compact, simple-septate, 3–4 or "4–6" μ (Boidin) in diameter; cystidia rare to abundant, subcylindrical to conical, usually incrusted, immersed, 50–70 × 7–10 μ; gloeocystidia numerous, cylindrical, flexuous, attenuate or obtuse, sometimes projecting up to 20 μ, 70–100 × 10–15 μ; basidia clavate, 40–60 × 8–12 μ; spores hyaline, smooth, nonamyloid, ellipsoid, apiculate, 12–18 × 6–11 μ.

On wood of Alnus in New York; reported from France.

This species is identical with 9. *P. aurantiaca* except in having simple-septate hyphae. According to Boidin these grow on different subgenera of Alnus. Weresub identified the collection (Slysh 448) which appears to be the first reported from New York.

11. *Peniophora subalba* (Burt) Rog. & Jacks. Fig. 11

Farlowia 1:298. 1943. *Corticium subalbum* Burt, Mo. Bot. Gard. Ann. 13:267. 1926. *C. pilosum* Burt (*fide* Rogers and Jackson, 1943, p. 298).

Fructifications widely effused, adnate, from white to buff, membranous; surface even, farinose, cracking; margin thinning out.

In section hyaline, 150–250 μ thick; hyphae very compactly arranged, thin-walled, nodose-septate, 2–4 μ in diameter; cystidia rare, cylindrical, rather thick-walled, obtuse, incrusted, immersed or projecting up to 30 μ, 40–60 × 6–12 μ; gloeocystidia abundant, from pyriform or ovoid to elongated, immersed, 20–80 × 12–18 μ; basidia cylindrical, 30–50 × 7–10 μ; spores hyaline, smooth, nonamyloid, cylindric-ellipsoid, flattened on one side, apiculate, 10–13 (–15) × 4.5–5 (–6) μ.

On wood of Alnus in Vermont and Georgia; not yet known from New York; reported from Alabama.

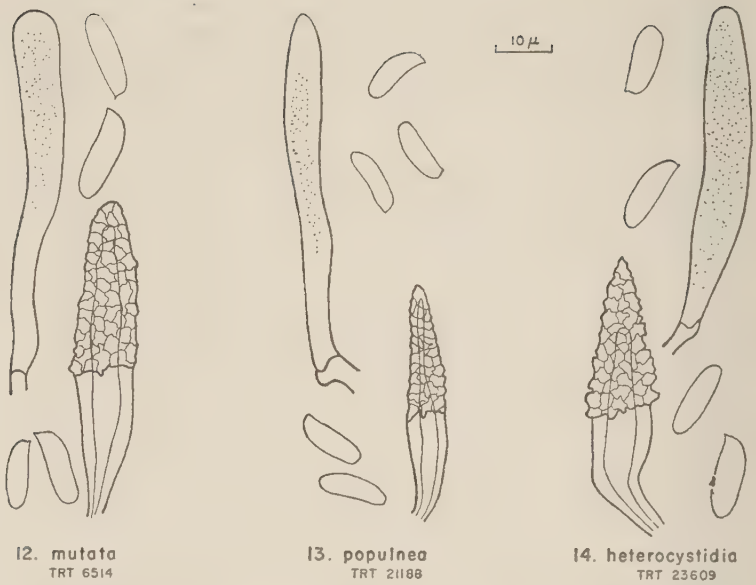
The spores and cystidia are intermediate between those of 17. *P. incarnata* on one hand, and those of 9. *P. aurantiaca* and 10. *P. eriksonii* on the other. See remarks under *P. aurantiaca,* and also those by Rogers and Jackson (1943, p. 298).

12. *Peniophora mutata* (Peck) Hoehn. & Litsch. Fig. 12

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1580. 1906. *Corticium mutatum* Peck, N. Y. State Mus. Rept. 43:69 [or 23]. 1890. *P. allescheri* (Bres.) Sacc. & Syd. (*fide* Rogers and Jackson, 1943, p. 313).

Fructifications widely effused, more or less separable, white to cream, membranous; surface minutely pilose, often tuberculate or odontioid, cracking on drying and curling away from the substratum; margin radiately fibrillose.

In section hyaline, 300–1000 μ thick; hyphae longitudinally and compactly arranged next to the substratum, then ascending, becoming loosely arranged, occasionally incrusted, rather thin-walled, nodose-septate, 3–4.5 μ in diameter; cystidia abundant to rare, cylindrical to subconical, subtended by a clamp connection, thick-walled, heavily incrusted, immersed or projecting up to 30 μ, 30–100 × 8–10



Figs. 12-14. — Microscopic features of species of Peniophora, all × 750. Fig. 12. Cystidium, gloeocystidium, and spores of *P. mutata*. Fig. 13. Same of *P. populnea*. Fig. 14. Same of *P. heterocystidia*.

μ; gloeocystidia abundant, of variable shape, cylindrical to clavate or pyriform, flexuous, 25–80 × 7–14 μ; basidia clavate, 30–45 × 8–10 μ; spores hyaline, smooth, nonamyloid, cylindrical, flattened on one side, apiculate, 10–16 × 3–4.5 μ.

On wood of angiosperms in New York, Michigan, Ontario, Idaho, France, and Latvia; reported as widespread in North America, Europe, West Indies, and Japan.

P. mutata is very similar to 13. *P. populnea* and 14. *P. heterocystidia*. All three are difficult or impossible to separate on microscopic characters alone. Thickness, color of the fruiting body and of its section, and the type of the substratum are important diagnostically in segregating these species. Thus *P. mutata* is up to 1000 μ thick, cream colored, but hyaline in section, and grows on all kinds of angiosperms. In contrast, *P. populnea* and *P. heterocystidia* are much thinner (up to 400 μ), and their fruit bodies are dark colored and brownish in section.

13. *Peniophora populnea* (Peck) Burt Fig. 13

Mo. Bot. Gard. Ann. 13:324. 1926. *Stereum populneum* Peck, N. Y. State Mus. Rept. 47:145 [or 19]. 1894.

Fructifications widely effused, adnate, sordid violaceous, membranous; surface even, deeply and frequently cracking; margin paler, radiately fibrillose.

In section more or less chestnut-brown, having a ragged appearance from the collapse of the hyphal tips, basidia and gloeocystidia, 200–400 μ thick; hyphae longitudinally arranged next to the substratum, elsewhere ascending, rather thin-walled, nodose-septate, 3.5–4.5 μ in diameter; cystidia few, cylindrical to subconical, thick-walled, heavily incrusted, immersed or projecting up to 20 μ, 30–45 × 5–7 μ; gloeocystidia few, cylindrical, flexuous, immersed but usually reaching the hymenial surface, 40–80 × 4–8 μ; basidia clavate, 20–40 × 6–7 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 11–12 × 3.5–4 μ, or "12–15 × 4 μ" (Burt, 1926b, p. 324).

On Populus in New York and Ontario; reported from Manitoba.

P. populnea occurs on Populus only, and the otherwise quite similar 14. *P. heterocystidia* is found on other angiosperms but not on Populus. *P. populnea* is homogeneous in section, and *P. heterocystidia* consists of two layers.

P. populnea Bourd. & Galz. (in Hymén. France, p. 282. 1928) and *P. populnea* (Peck) Burt are homonyms of two different species, as is evident from a comparison of Bourdot and Galzin's description. They state that the cystidia in their species are conical, acicular, emerging two-thirds of their length, 90–110 × 6–9 μ, and the spores subglobose, 4–6–6.5 × (3.5–)5–6 μ.

14. *Peniophora heterocystidia* Burt Fig. 14

Mo. Bot. Gard. Ann. 12:293. 1926. *P. kauffmanii* Burt (*fide* Rogers and Jackson, 1943, p. 317).

Fructifications at first in patches then coalescing and widely effused, adnate, pinkish-drab, membranous; surface even, minutely pilose; margin whitish, radiately fibrillose.

In section of two layers, brownish above, 200–400 μ thick; hyphae more or less loosely arranged, becoming more compact toward the hymenium, thin- or rather thin-walled, nodose-septate, 3–5 μ in diameter; cystidia abundant, cylindrical to clavate, or subfusiform, thick-walled, heavily incrusted, usually immersed but some projecting up to 40 μ, mostly 25–45 × 6–12 μ; large masses of crystals

found in the lower part of the brownish layer up to 40 μ in diameter; gloeocystidia numerous, cylindrical, flexuous, immersed or projecting up to 20 μ, 40–90 × 4.5–10 μ; basidia subclavate, slightly constricted in the middle, 20–30 × 6–7 μ; spores hyaline, smooth, nonamyloid, cylindrical, flattened on one side, apiculate, 12–15 × 3.5–4.5 μ.

On wood of angiosperms in New York, Ontario, Quebec, Illinois, and Kentucky; reported as widespread in eastern North America.

P. heterocystidia has been found on various angiosperms but not as yet on Populus. In contrast 13. *P. populnea* occurs on Populus only, and it is homogeneous in section.

15. *Peniophora violaceo-livida* (Sommerf.) Massee Fig. 15

Linn. Soc. Jour. Bot. 25:152. 1889. *Thelephora violaceo-livida* Sommerf., Suppl. Fl. Lapp., p. 283. 1826.

Fructifications at first discrete, then coalescing and becoming widely effused, adnate, grayish-violaceous, waxy; surface pruinose, often tuberculate, cracking; margin whitish, minutely fibrillose.

In section brownish, 100–200 μ thick; hyphae brownish, compactly arranged, rather thin-walled, nodose-septate, 3–4 μ in diameter; cystidia few, conical, thick-walled, heavily incrusted, immersed or only slightly projecting, 15–30 × 5–8 μ; gloeocystidia usually scarce, clavate, immersed, 15–30 × 7–10 μ; basidia more or less cylindrical, 20–30 × 5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 7–8 × 2–3 μ.

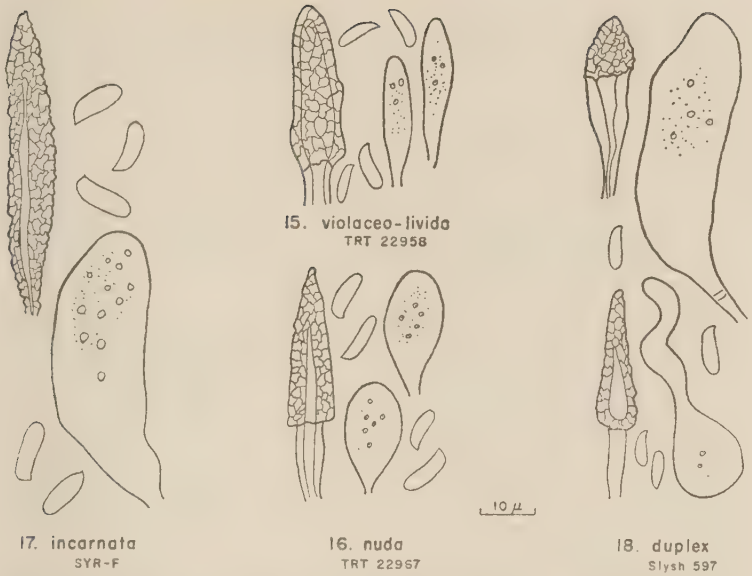
On wood of angiosperms in New York and Ontario; reported as widespread in North America and Europe.

The presence of gloeocystidia distinguishes this species from 73. *P. cinerea,* 85. *P. pithya,* and 68. *P. quercina.* As a rule, *P. violaceo-livida* has rare, clavate gloeocystidia which rarely exceed the diameter of 10 μ. The otherwise similar 16. *P. nuda* differs in having abundant, inflated gloeocystidia 10–20 μ in diameter.

The fruiting bodies of *P. violaceo-livida* so far seen have been widely and uniformly effused. The juvenile growth habit of discrete patches was unrecognizable in mature plants. In contrast, the patches of *P. nuda* retain their individuality.

16. *Peniophora nuda* (Fries) Bres. Fig. 16

I. R. Accad. Sci. Lett. Rovereto, Atti, III, 3:114. 1897. *Thelephora nuda* Fries, Syst. Myc. 1:447. 1821.



Figs. 15-18. — Microscopic features of species of Peniophora, all × 750. Fig. 15. Cystidium, gloeocystidia, and spores of *P. violaceo-livida*. Fig. 16. Same of *P. nuda*. Fig. 17. Same of *P. incarnata*. Cystidium drawn from Strasser coll. at Sontagberg (in BPI), gloeocystidium and spores drawn from Slysh 867. Fig. 18. Same of *P. duplex*.

Fructifications somewhat effused, at first in small patches, expanding and adjoining but remaining more or less discrete, adnate, pale purplish-gray, waxy; surface pruinose, cracking on drying; margin paler, minutely fibrillose.

In section brownish, 100–200 μ thick; hyphae brownish, vertically arranged for the most part, compact, rather thin-walled, nodose-septate, 3–4 μ in diameter; cystidia numerous, conical, thick-walled, heavily incrusted, mostly immersed, 20–35 × 5–9 μ; gloeocystidia usually abundant, mostly inflated, 30–45 × 10–20 μ; basidia subclavate, 20–25 × 5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, curved, 7–9 × 2–3 μ.

On wood of angiosperms in New York, Ontario, France, Germany, and Finland; reported as widespread in North America, Europe, and South Africa.

This species resembles 73. *P. cinerea*, 85. *P. pithya*, 68. *P. quercina*, and 15. *P. violaceo-livida*. From the first three it differs in having gloeocystidia, and from the last in having more abundant and larger

gloeocystidia. This distinction is a relative one and there are intergrading conditions which make determination of many specimens difficult.

P. violaceo-livida differs also in its growth habit. It was uniformly and widely effused in all specimens seen.

17. *Peniophora incarnata* (Pers. ex Fries) Karst. Fig. 17

Hedwigia 28:27. 1889. *Thelephora incarnata* Pers. ex Fries, Syst. Myc. 1:444. 1821. *T. incarnata* Pers., Syn. Fung., p. 573. 1801.

Fructifications somewhat effused, usually in small patches which coalesce, adnate, bright orange to pinkish-cinnamon, waxy; surface even or sometimes papillose, farinose, often cracking and showing the paler subiculum in the fissures; margin finely fibrillose.

In section hyaline, 100–300 μ thick; hyphae mostly vertically and compactly arranged, rather thin-walled, nodose-septate, 3–4.5 μ in diameter; cystidia few, conical, heavily incrusted, immersed, 30–60 × 8–12 μ; gloeocystidia abundant, flexuous, some cylindrical, most short and ovoid, 30–100 × 10–15 μ; basidia narrowly clavate, 25–40 × 5–7μ; spores hyaline, smooth, nonamyloid, broadly cylindrical, flattened on one side, 7–10 × 2.5–4 μ.

On wood of angiosperms in New York, Ontario, British Columbia, and Germany; reported as widespread in North America, Europe, Japan, New Zealand, and South Africa.

The bright orange color of the fruiting body is distinctive for this species. No. 9. *P. aurantiaca* and 10. *P. erikssonii* are similar microscopically except they have much larger spores, 12–18 × 6–11 μ. In addition *P. erikssonii* differs in having simple-septate hyphae. See also the note under *P. aurantiaca*.

18. *Peniophora duplex* Burt Fig. 18

Mo. Bot. Gard. Ann. 12:298. 1926. *Corticium overholtsii* Burt (*fide* Rogers and Jackson, 1943, p. 296).

Fructifications somewhat effused, adnate, yellowish-cream or more often pinkish-buff, waxy; surface pruinose; margin radiately fibrillose, curling away from the substratum.

In section hyaline, 100–250 μ thick; hyphae very compactly arranged, gelatinized, rather thin-walled, nodose-septate, 2.5–4 μ in diameter; cystidia abundant, irregularly cylindrical to subconical, usually pointed, thick-walled, incrusted or not incrusted, immersed or projecting up to 30 μ, 30–60 × 7–10 μ; gloeocystidia abundant,

subfusiform to clavate, immersed, 25–45 × 7–12 μ; basidia subclavate, 20–25 × 4–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, curved, 5–7.5 × 2–2.5 μ.

On bark of gymnosperms in New York, Massachusetts, and Maryland; reported as widespread in the eastern United States.

Rogers and Jackson (1943, p. 297) suggest that *P. duplex* might be a growth phase or variety of *Stereum pini* (Schleich. ex Fries) Fries, and that "further study, involving cultures" is needed to clarify the position of this species.

19. *Peniophora tenuis* (Pat.) Massee Fig. 19

Linn. Soc. Jour. Bot. 25:149. 1889. *Corticium tenue* Pat., Rev. Mycol. 7:152. 1885. *Peniophora pertenuis* (Karst.) Burt, and *P. praetermissa* Karst. (*fide* Rogers and Jackson, 1943, p. 322).

Fructifications somewhat effused, adnate, white to cream, membranous becoming waxy with age; surface pruinose; margin thinning out.

In section hyaline, 100–200 μ thick; hyphae more or less vertically arranged, thin-walled, nodose-septate, 2.5–4.5 μ in diameter; cystidia frequent and very variable, some slightly enlarged at the base, rounded or pointed above, others cylindrical, capitate, all rather thin-walled, usually not incrusted, projecting up to 50 μ, 30–80 × 5–8 μ; gloeocystidia few, cylindrical or more often subulate, flexuous, 30–80 × 6–16 μ; basidia subclavate, constricted in the middle, 20–30 × 6–9 μ; spores hyaline, smooth, nonamyloid, cylindrical, flattened on one side or slightly curved, 8–12 × 3.5–6 μ.

On wood of angiosperms and gymnosperms in New York, Ontario, France, Austria, and Poland; reported as widespread in the temperate zone of North America, Europe, and South Africa.

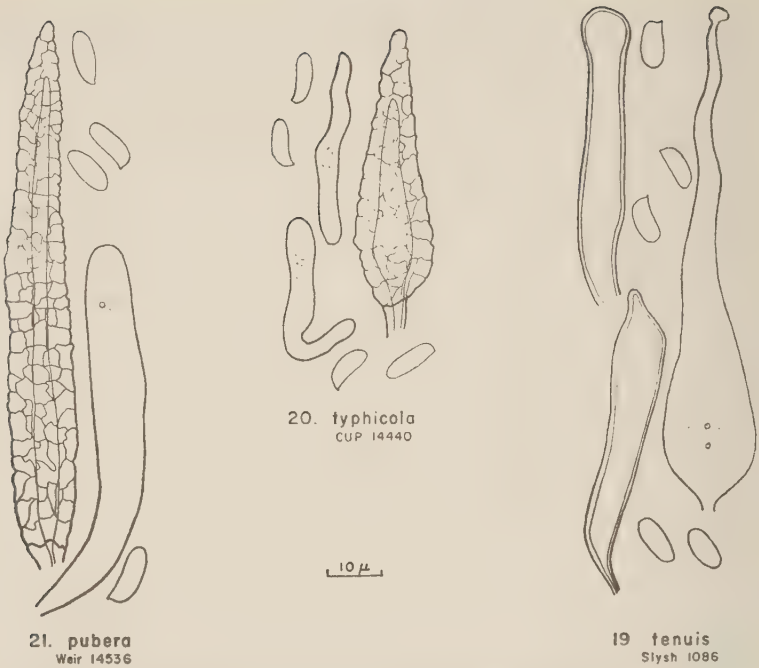
The variability of the cystidia is a distinctive characteristic of *P. tenuis*. The variation and extensive synonymy of this species are discussed at length by Rogers and Jackson (1943, p. 322).

20. *Peniophora typhicola* Burt Fig. 20

Mo. Bot. Gard. Ann. 12:319. 1926.

Fructification somewhat effused, adnate, whitish, membranous; surface even, pruinose; margin pruinose.

In section hyaline, 60–120 μ thick; hyphae vertically arranged, compact, indistinct, thin-walled, nodose-septate, 2–3 μ in diameter; cystidia few, conical, thick-walled, heavily incrusted, usually im-



FIGS. 19-21. — Microscopic features of species of Peniophora, all × 750. FIG. 19. Cystidia, gloeocystidium, and spores of *P. tenuis*. FIG. 20. Same of *P. typhicola*. FIG. 21. Same of *P. pubera*.

mersed, 30–45 × 10–15 μ; gloeocystidia rare, immersed, cylindrical, flexuous, 25–40 × 5–7 μ; basidia clavate, 15–25 × 6–8 μ; spores hyaline, smooth, nonamyloid, cylindrical, flattened on one side or slightly curved, 10–11 × 3.5–4.5 μ.

On *Typha latifolia* L. in New York.

No structures corresponding to "paraphyses with filiform tips," as mentioned by Burt in his description, have been observed.

The fruiting body of this species closely resembles poorly developed fructifications of 21. *P. pubera*, which appears to differ in having larger cystidia (50–90 × 10–18 μ), larger gloeocystidia (45–60 × 5–10 μ), and smaller, 7–9.5 × 3.5–4.5 μ, spores. If host specificity is considered a diagnostic criterion, there is no doubt as to the validity of this species.

21. *Peniophora pubera* (Fries) Sacc. Fig. 21

Syll. Fung. 6:646. 1888. *Thelephora pubera* Fries, Elench. Fung. 1:215. 1828. *Peniophora subtilis* (Schroet.) Hoehn. & Litsch. and *P. tenuissima* Peck (*fide* Rogers and Jackson, 1943, p. 325).

Fructifications widely effused, adnate, whitish to cream, waxy; surface usually distinctly setulose; margin indeterminate.

In section hyaline, 100–300 μ or "45–400 μ" thick (Burt, 1926, p. 313); hyphae vertically arranged, compact, thin-walled, nodose-septate, 3–4.5 μ in diameter; cystidia abundant, narrowly conical, thick-walled, heavily incrusted, immersed or projecting up to 50 μ, 50–90 × 10–18 μ; gloeocystidia rare, cylindrical, flexuous, immersed, 45–60 × 5–10 μ; basidia subclavate, 20–30 × 5–8 μ; spores hyaline, smooth, nonamyloid, cylindrical, flattened on one side, 7–9.5 × 3.5–4.5 μ.

On wood of angiosperms or rarely gymnosperms in New York, Ontario, and Idaho; reported throughout the temperate zone of North America and Europe.

No. 20. *P. typhicola* is very similar but differs in its larger spores (10–11 × 3.5–4.5 μ) and in having a more poorly developed fructification. Also it grows only on Typha. *P. tenella* Burt is a probable synonym. It seems to be indistinguishable. A specimen (TRT 14286) at Univ. of Toronto Herbarium, annotated by Jackson, suggests this synonymy.

Section IV

Cystidial walls dissolving in 10% KOH solution, the cystidia broadened or rooted at the base (except in 22. *P. crassa*); lumina capillary (except in 23. *P. hamata*); spores nonamyloid, the walls smooth; gloeocystidia absent; hyphae nodose-septate.

The dissolution of the cystidial wall in KOH is the diagnostic characteristic for this section. This can be detected by mounting a section in Meltzer's solution and comparing it with one in 10% KOH. The process of dissolution may be also observed directly by first mounting a section in 3% KOH and then adding 10% KOH to the edge of the coverglass.

Minute differences in the structure of the cystidium are used to segregate species in this section. The thick cystidial wall apparently is not homogeneous. A very thin portion which surrounds the capillary lumen appears to have different chemical properties, as it does not dissolve in KOH. The part of the cystidium next to the substratum is provided with branching, rootlike extensions, here re-

ferred to as roots, or it is simply broadened. A thin-walled apical bulb is formed in the upper part of the cystidium by the expansion of the lumen.

For a more detailed discussion of the morphology of the cystidium in this section see Weresub (1953).

KEY TO THE SPECIES

1. Cystidial base broadened or rooted; fruiting body up to 200 μ thick 2
1. Cystidial base not broadened and not rooted, becoming an unmodified hypha; fruiting body over 1000 μ thick ..... 22. *P. crassa*
2. Lumen noncapillary; cystidia terminated by an umbrella-like structure ..... 23. *P. hamata*
2. Lumen capillary, not expanding; cystidia attenuated, apex undifferentiated ..... 24. *P. chaetophora*
2. Lumen capillary, expanding to form an apical bulb 3
3. Lumen of the cystidium expanding to form an apical bulb distinctly broader than the diameter of the cystidium 4
3. Lumen of the cystidium expanding to form an apical bulb which never exceeds the diameter of the cystidium 6
4. Spores cylindrical, 5–7 × 1.5–2 μ ..... 25. *P. juniperina*
4. Spores ellipsoid, 3–6 × 2–4.5 μ 5
5. Cystidial neck very narrow, 1–1.5 μ in diameter ..... 26. *P. sceptrifera*
5. Cystidial neck broader, 3–4.5 μ in diameter ..... 27. *P. accedens*
6. Cystidia cylindrical; apex symmetrical, obtuse 7
6. Cystidia cylindrical to conical; apex tapering to a sharp point 10
6. Cystidia conical; apex asymmetrical, or with a cap 11
7. Capillary lumen expanding gradually 8
7. Capillary lumen expanding abruptly 9
8. Cystidia 4–5 μ in diameter; spores 7–11 μ long ..... 28. *P. angusta*
8. Cystidia 6–9 μ in diameter; spores 6–7 μ long ..... 29. *P. media*
9. Apical bulb short, rounded ..... 30. *P. propinqua*
9. Apical bulb cylindrical ..... 31. *P. gracillima*
10. Cystidia 7–15 μ in diameter above the base ..... 32. *P. subulata*
10. Cystidia 5–7 μ in diameter above the base ..... 33. *P. hirtella*
11. Apex asymmetrical, cowl-like ..... 34. *P. calothrix*
11. Apex covered with a cap which persists in KOH ..... 35. *P. inornata*

22. *Peniophora crassa* Burt Fig. 22

Ex Peck in N. Y. State Mus. Rept. 54:155. 1901. Mo. Bot. Gard. Ann. 12:286. 1926.

Fructifications widely effused, separable, ochraceous-buff, thick-membranous, of two layers; surface compact, pruinose, rarely but then deeply cracking, somewhat hispid, continued to an abrupt and reflexed margin, or margin finely floccose and gradually thinning out.

In section hyaline, up to 1500 μ thick, with a distinct basal layer, scattered with crystals throughout; hyphae vertically arranged, from thin- to thick-walled, nodose-septate, 2–4.5 μ in diameter; cystidia abundant, often scarcely differentiated, cylindrical, with a capillary lumen expanding gradually and forming an obtuse apex, somewhat incrusted, the walls dissolving in 10% KOH, immersed or projecting up to 35 μ, 60–100 or more × 6–9 μ; basidia cylindrical, up to 45 μ long, 2–3.5 μ in diameter; spores hyaline, smooth, nonamyloid, cylindrical, curved, 5–7.5 × 1.5–2 μ.

On wood of gymnosperms in New York, Ontario, North Carolina, Tennessee, Idaho, Oregon, and British Columbia; reported as widespread in temperate and boreal North America.

The distinctive features of *P. crassa* are its thick, almost fleshy fruiting body consisting of two layers, and its cystidia which are but the terminations of vertically arranged and gradually modified hyphae.

23. *Peniophora hamata* Jacks. Fig. 23

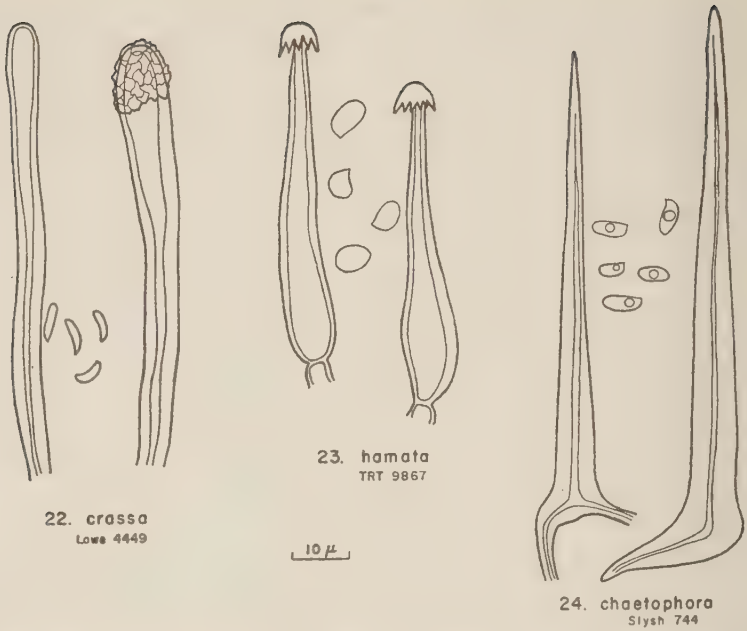
Canad. Jour. Res. 26(C):133. 1948.

Fructifications widely effused, adnate, white, reticulate to "subpelliculose" (Jackson); surface discontinuous; margin indeterminate.

Subiculum composed of thin-walled, nodose-septate hyphae 2–3.5 μ in diameter; cystidia abundant, rooted, subulate, rather thin-walled, bearing umbrella-shaped terminal caps with 10-12 prongs which are 2–3 μ long, the walls dissolving in 10% KOH except the cystidial neck and cap, 30–60 μ long, 5–8 μ broad at the base and 2–3.5 μ at the neck; basidia subclavate, 16–20 × 6–8 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid, flattened on one side, apiculate, 6–7.5 × 4–4.5 μ.

On wood of gymnosperms in Ontario; not yet known from New York.

P. hamata is easily recognized by the cystidia with their peculiar caps. *P. umbracula* Cunn., reported by Cunningham (1955, p. 291)



FIGS. 22-24. — Microscopic features of species of Peniophora, all × 750. FIG. 22. Cystidia and spores of *P. crassa*. FIG. 23. Same of *P. hamata*. FIG. 24. Same of *P. chaetophora*.

from New Zealand, has very similar cystidia but according to his description differs in its spore size, 5–6 × 3–3.5 μ.

24. *Peniophora chaetophora* (Hoehn.) Hoehn. & Litsch. Fig. 24
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 116 (Abt. 1):748. 1907. *Hypochnus chaetophorus* Hoehn., same, vol. 111 (Abt. 1):1007. 1902. *Peniophora dissoluta* Overh. (*fide* Rogers and Jackson, 1943, p. 316).

Fructifications effused, membranous, some areas appearing reticulate (because, apparently, of the hyphae which cluster around the cystidia), separable, white to cream, cracking deeply into small areas; surface setulose, interrupted; margin concolorous, thinning out.

In section hyaline, up to 200 μ thick; hyphae rather thin-walled, nodose-septate, 2–4 μ in diameter; cystidia abundant, narrowly conical, not incrusted, thick-walled, with a capillary lumen, distinctly amyloid, projecting about two-thirds of their length, the walls dissolving in 10% KOH, 120–200 × 6–10 μ; basidia cylindrical, 10–16 ×

4–5 μ; spores hyaline, smooth, nonamyloid, ellipsoid to cylindrical, flattened on one side, 6–7.5 × 2.5–4 μ.

On wood of gymnosperms in New York, Ontario, and France; reported from Massachusetts, Pennsylvania, California, Oregon, Idaho, British Columbia, and Austria.

This species is the only one of the plants considered in this section that has undifferentiated termination of the cystidium and also has the capillary lumen of more or less uniform diameter for its entire length.

25. *Peniophora juniperina* (Bourd. & Galz.) Bourd. & Galz. Fig. 25
Hymén. France, p. 289. 1928. *P. media* Bourd. & Galz., subsp. *juniperina* Bourd. & Galz., Soc. Myc. France Bul. 28:386. 1913.

Fructifications somewhat effused, adnate, pale gray, thin-membranous; surface even, pilose from the projecting cystidia; margin pruinose, thinning out.

In section hyaline, 25–50 μ thick; hyphae difficult to distinguish, thin-walled, nodose-septate, 2–3 μ in diameter; cystidia abundant, with a capillary lumen abruptly expanding toward the tip to form a thin-walled bulb 8–11 μ in diameter, occasionally slightly incrusted, the stem narrowing to a neck 3–4.5 μ in diameter, the walls slightly amyloid and dissolving in 10% KOH, projecting up to 60 μ, 50–90 × 4–8 μ; basidia subclavate, 10–15 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, curved, 5–7 × 1.5–2 μ.

On wood of gymnosperms in Ontario and France; not yet known from New York; reported from Massachusetts, Idaho, Oregon, British Columbia, and Sweden.

No. 27. *P. accedens* and 26. *P. sceptrifera* have similar apical bulbs. *P. accedens* differs in its broader and smaller spores (3–5.5 × 2–3 μ), and *P. sceptrifera* differs in having broader spores (3–4.5 μ) and a very narrow cystidial neck (1–1.5 μ).

26. *Peniophora sceptrifera* Jacks. & Weres. Fig. 26
Canad. Jour. Bot. 31:772. 1953.

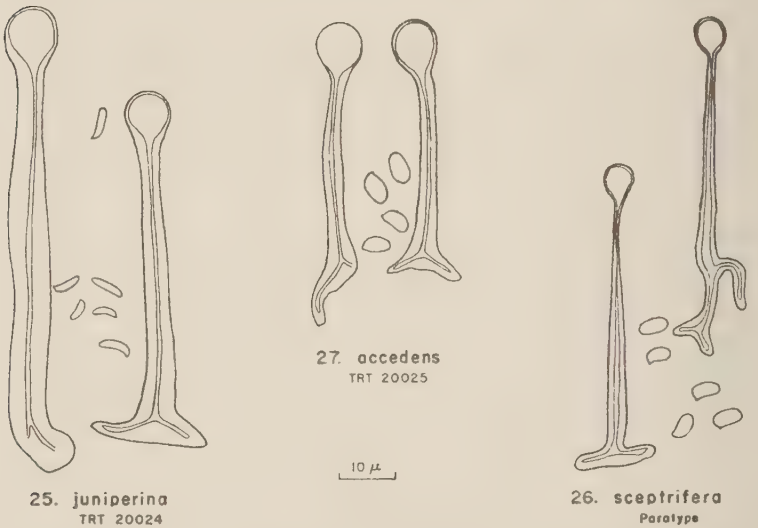
Fructifications somewhat effused, adnate, grayish, pruinose, without substantial subiculum; surface pruinose; margin indeterminate.

Hyphae more or less longitudinally arranged, thin- to rather thick-walled, nodose-septate, 1.5–2 μ in diameter; cystidia abundant, rooted, narrow-conical, with a capillary lumen expanding abruptly and forming a thin-walled apical bulb 4–6 μ in diameter, the walls dissolving in 10% KOH, projecting up to 40 μ, 45–60 μ long, 2–3 μ

wide at the base, 1–1.5 μ wide at the neck; basidia clavate, 10–15 × 4–5 μ; spores hyaline, smooth, broadly ellipsoid or "sometimes almost subglobose" (Weresub, 1953, p. 772), flattened on one side, apiculate, 5–6 × 3–4.5 μ.

On wood of gymnosperms in Ontario; reported also on a liverwort; not yet known from New York.

Other species with similar apical bulbs are 27. *P. accedens* and 25. *P. juniperina*. Both differ in having more cylindrical spores.



FIGS. 25-27. — Microscopic features of species of Peniophora, all × 750. FIG. 25. Cystidia and spores of *P. juniperina*. FIG. 26. Same of *P. sceptrifera*. Drawn from paratype. FIG. 27. Same of *P. accedens*.

27. *Peniophora accedens* (Bourd. & Galz.) Wakef. & Pears. Fig. 27
Brit. Mycol. Soc. Trans. 6:140. 1920. *P. effugiens* Bourd. & Galz. subsp. *P. accedens* Bourd. & Galz., Soc. Myc. France Bul. 28:386. 1913.

Fructifications effused, very delicate, adnate, grayish, pruinose, without an obvious subiculum; surface discontinuous, finely pilose from the projecting cystidia; margin thinning out.

Hyphae compactly arranged, thin-walled, nodose-septate, 1.5–2 μ in diameter; cystidia abundant, rooted, projecting four-fifths of their length, stem cylindrical, uniformly 3–4.5 μ in diameter or only slightly attenuate towards the neck, lumen capillary, expanding into an apical bulb 5–8 μ in diameter, always larger than the stem, the walls dissolving in 10% KOH, the whole 35–70 μ long; basidia

clavate, 7.5–12 × 3.5–4.5 μ; spores hyaline, smooth, nonamyloid, cylindric-ellipsoid to ellipsoid, flattened on one side, 3–4.5 (–5.5) × 2–3μ.

On wood of angiosperms and gymnosperms in Ontario and France; not yet known from New York; reported from Quebec, Massachusetts, Rhode Island, Iowa, Oregon, and British Columbia.

The diagnostic feature of *P. accedens* is the combination of the enlarged apical bulb of the cystidium and the short spores. No. 25. *P. juniperina* has similar cystidia (although occasionally incrusted) but differs in having distinctly cylindrical spores 5–7 × 1.5–2 μ. No. 26. *P. sceptrifera* has larger spores, 5–6 × 3–4.5 μ, and its cystidial stem narrows to a very thin neck (1–1.5 μ).

28. *Peniophora angusta* Rog. & Weres. Fig. 28
Canad. Jour. Bot. 31:764. 1953.

Fructifications somewhat effused, delicate, without substantial subiculum, "when fresh, waxy pruinose or farinose" (Weresub, 1953, p. 764), grayish; surface discontinuous, pilose from the projecting cystidia; margin indeterminate.

Hyphae loosely arranged, thin- to thick-walled, nodose-septate, 2–3 μ in diameter; cystidia abundant, cylindrical, with a capillary lumen gradually expanding to form a thin-walled, obtuse, cylindrical apical tube, the walls dissolving in 10% KOH, projecting up to 70 μ, 60–100 × 4–5 μ; basidia subclavate, 10–16 × 3.5–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, sometimes slightly curved, 7–11 × 1.5–2 μ.

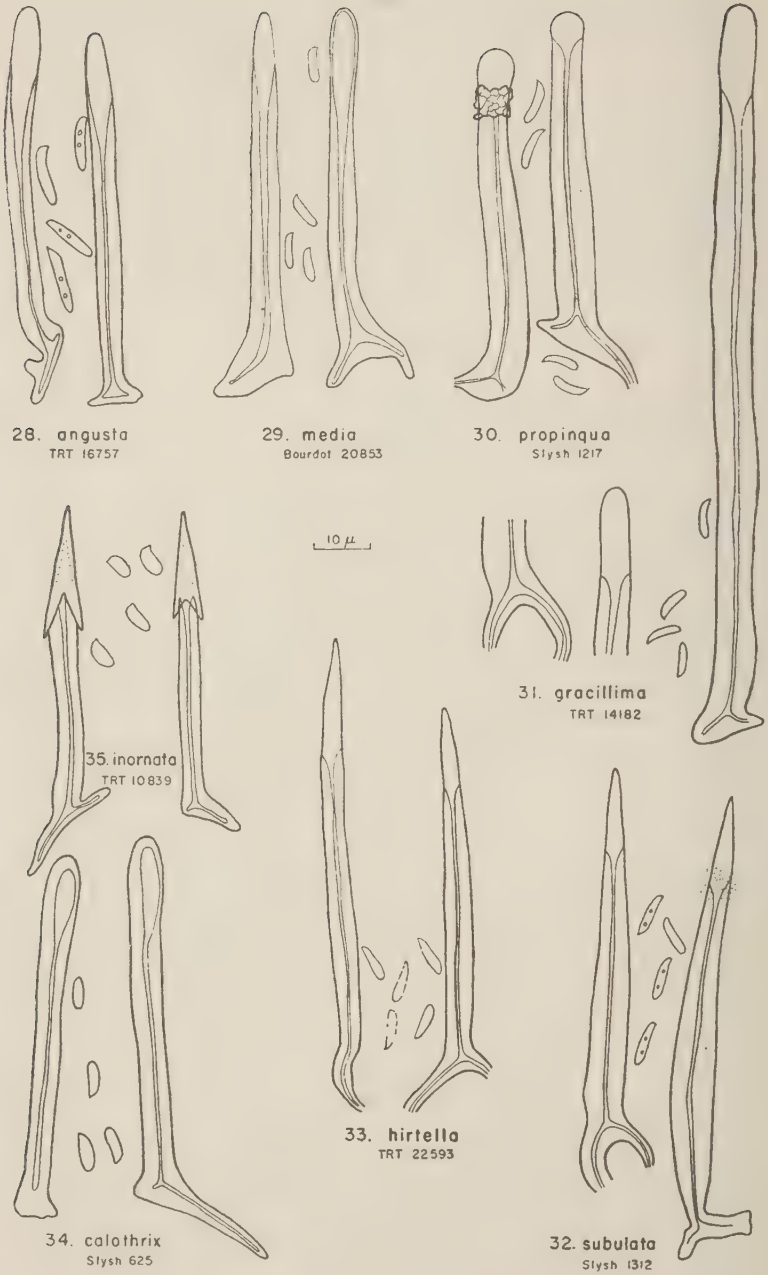
On wood of angiosperms and gymnosperms in Ontario; not yet known from New York; reported from Massachusetts, Rhode Island, Oregon, and British Columbia.

The extremely slender cystidia are diagnostic for this species. Species otherwise similar but with broader cystidia are 29. *P. media,* 30. *P. propinqua,* and 31. *P. gracillima.*

29. *Peniophora media* Bourd. & Galz. Fig. 29
Soc. Myc. France Bul. 28:385. 1913.

Fructifications somewhat effused, separable, cream, membranous, with a scanty subiculum; surface rough, pilose from the projecting cystidia; margin thinning out, pruinose.

In section hyaline, up to 100 μ thick; hyphae indistinct and collapsing, with thin but firm walls, nodose-septate, 2.5–4 μ in diameter;


28. angusta
TRT 16757
29. media
Bourdot 20853
30. propinqua
Slysh 1217
10 μ
31. gracillima
TRT 14182
35. inornata
TRT 10839
33. hirtella
TRT 22593
34. calothrix
Slysh 625
32. subulata
Slysh 1312

cystidia abundant, cylindrical, with a capillary lumen which expands gradually to form a thin-walled apical bulb, the walls slightly amyloid and dissolving in 10% KOH, projecting for almost their entire length, 60–90 × 6–9 μ; basidia subclavate, flexous, 10–15 × 4.5–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, curved, 6–7 × 1.5–2 μ.

On wood of gymnosperms in France; not yet known from New York.

The species is included here because of its similarity to 31. *P. gracillima*. The main difference is in the capillary lumen which expands gradually in *P. media*, abruptly in *P. gracillima*.

30. *Peniophora propinqua* Bourd. & Galz. Fig. 30
Hymén. France, p. 288. 1928.

Fructifications somewhat effused, more or less adnate, white to cream, membranous; surface deeply cracking, pilose from the projecting cystidia; margin pruinose, thinning out.

In section hyaline, 100–200 μ thick; hyphae thin- to rather thin-walled, nodose-septate, 2–3.5 μ in diameter; cystidia abundant, cylindrical, rooted, sometimes incrusted around the apex, with a capillary lumen expanding abruptly to form a thin-walled, short, rounded apex which frequently exceeds the diameter of the cystidial neck, the walls dissolving in 10% KOH, immersed or projecting up to 60 μ, 60–120 × 7–12 μ; basidia clavate, 15–20 × 3–4 μ; spores hyaline, smooth, cylindrical, slightly curved, 5–8 × 1.5 μ.

On wood of gymnosperms in New York and Ontario; reported from France and Sweden.

The short, rounded, slightly enlarged apex of the cystidium is the diagnostic feature of this species. No. 31. *P. gracillima* is very similar except that the apices of its cystidia are cylindrical, up to 20 μ long, and never exceed the diameter of the cystidial neck.

31. *Peniophora gracillima* Ell. & Everh. Fig. 31
Rogers and Jackson in Farlowia 1:317. 1943. *P. glebulosa* sense of Bres., Burt, Mo. Bot. Gard. Ann. 12:282. 1926 (*fide* Rogers and Jackson, 1943, p. 317).

Figs. 28-35. — Microscopic features of species of Peniophora, all × 750. Fig. 28. Cystidia and spores of *P. angusta*. Fig. 29. Same of *P. media* (in FH). Fig. 30. Same of *P. propinqua*. Fig. 31. Same of *P. gracillima*. Fig. 32. Same of *P. subulata*. Fig. 33. Same of *P. hirtella*. Fig. 34. Same of *P. calothrix*. Fig. 35. Same of *P. inornata*.

Fructifications effused, adnate, yellowish-tan, membranous, cracking deeply on drying and showing the white subiculum in the fissures; surface pilose from the projecting cystidia; margin indeterminate, arachnoid.

In section hyaline, 100–200 μ thick; hyphae vertically arranged, thin- to moderately thick-walled, nodose-septate, 2–3 μ in diameter; cystidia numerous, cylindrical, rooted, the walls dissolving in 10% KOH, projecting up to 75 μ, 60–170 × 6–10 μ, with capillary lumina which enlarge rather abruptly to form apical tubes (up to 20 μ long) always more narrow than the cystidial stems; basidia subclavate, 15–25 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 7–9 × 1.5–2 μ.

On wood of gymnosperms in New York, New Jersey, Ontario, and Oregon; reported as widespread in North America, Europe, and South Africa.

No. 29. *P. media* and 30. *P. propinqua* differ from this species only in the nature of their capillary lumina. In *P. media* the lumen expands gradually; in *P. propinqua* it expands abruptly, but the apex that is formed is short and rounded and usually exceeds the diameter of the cystidial neck.

32. *Peniophora subulata* Bourd. & Galz. Fig. 32
Soc. Myc. France Bul. 28:385. 1913.

Fructifications somewhat effused, adnate, white to cream, "submembraneux" (Bourdot and Galzin, 1928, p. 289); surface discontinuous, pilose from the projecting cystidia; margin indeterminate.

In section hyaline, 50–150 μ thick; hyphae rather thin-walled, nodose-septate, 2–3 μ in diameter; cystidia abundant, conical, rooted, with a capillary lumen which expands abruptly to form an acute conical apex, often finely incrusted around the tip, the walls dissolving in 10% KOH, immersed or projecting up to 60 μ, 50–80 × 7–15 μ; basidia clavate, 15–20 × 3–4 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 6–9 × 1.5–2 μ.

On wood of gymnosperms in New York, Ontario, British Columbia, and France; reported as widespread from the temperate zone of North America and Europe.

The acute apex of the cystidium is a feature shared by 33. *P. hirtella,* which differs in having a more narrow cystidial stem 5–7 μ in diameter.

33. *Peniophora hirtella* Bourd. & Galz. Fig. 33
Soc. Myc. France Bul. 28:386. 1913.

Fructifications somewhat effused, adnate, grayish, floccose, delicate, without substantial subiculum; surface discontinuous, pilose from the projecting cystidia; margin indeterminate.

Hyphae rather thin-walled, nodose-septate, indistinct, 3–4 μ in diameter; cystidia abundant, cylindrical, rooted, not incrusted, with a capillary lumen which expands abruptly to form a thin-walled, usually conical apex, the walls dissolving in 10% KOH, projecting up to 60 μ, 50–90 × 5–7 μ; basidia subclavate, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly narrowing toward one end ("oblongues claviformes," Bourdot and Galzin, 1928, p. 291), slightly curved, 7–9 × 2–2.5 μ.

On wood of gymnosperms in Ontario and France; not yet known from New York.

The species closely resembles 32. *P. subulata,* which differs principally in the much greater diameter (7–15 μ) of the cystidial stem.

34. *Peniophora calothrix* (Pat.) Rog. & Jacks. Fig. 34
Farlowia 1:316. 1943. *Corticium calothrix* Pat., Cat. Rais. Pl. Cell. Tunisie, p. 59. 1897. *Peniophora pirina* Bourd. & Galz. and *P. delectans* Overh. (*fide* Rogers and Jackson, 1943, p. 316).

Fructifications widely effused, more or less adnate, cream to gray, soft-membranous; surface discontinuous, pilose from the projecting cystidia; margin indeterminate.

In section hyaline, 50–150 μ thick; hyphae with rather thin amyloid walls, nodose-septate, 1.5–2.5 μ in diameter; cystidia abundant, cylindrical, rooted, slightly incrusted around the obtuse apex, walls amyloid, dissolving in 10% KOH, with a capillary lumen enlarging asymmetrically and thus the apex of the cystidium appearing covered as if with a cowl, projecting up to one-half of their length, 50–75 × 5–8 μ; basidia clavate, the basal walls amyloid, 10–16 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical to oblong-ellipsoid, 5.5–7.5 × 2–3 μ.

On wood of gymnosperms in New York, Ontario, and Tunisia; reported from "both coasts, in Iowa, and as far south as Tennessee" (Rogers and Jackson, 1943, p. 316), and from France.

The unique cystidia and the amyloid reaction of the hyphae and basidia are highly distinctive features of this species.

35. *Peniophora inornata* Jacks. & Rog. Fig. 35
Canad. Jour. Res. 26(C):139. 1948.

Fructifications somewhat effused, reticulate, white; surface discontinuous, pruinose, pilose from the projecting cystidia; margin indeterminate.

Subiculum hyphae longitudinally arranged, rather thin-walled, nodose-septate, 2.5–3.5 μ in diameter; cystidia abundant, conical, with capillary lumen, rooted, with pointed terminal caps, dissolving (all except the cap) in 10% KOH, projecting for almost their entire length, 50–80 × 4–7 μ; basidia cylindrical, 12–15 × 3–4.5 μ; spores hyaline, smooth, nonamyloid, ellipsoid, flattened on one side, 4.5–6 × 2.5–3.5 μ.

On wood of gymnosperms in Ontario; not yet known from New York; reported from Oregon.

The distinctive cap is the characteristic feature of this species. Often only one-half of the cap is formed.

Section V

Cystidia septate (and with another distinct type in 40. *P. pallidula*), persisting in 10% KOH; spores nonamyloid, the wall smooth; gloeocystidia absent; hyphae hyaline or colored, nodose-septate.

The septation of the cystidia is the distinctive characteristic for this section. In some specimens the septation of cystidia may not be consistent, that is, in some the septa may be absent, just as in some species with normally nonseptate cystidia septa may be found occasionally, *e.g.*, in *P. sanguinea* or *P. sambuci*. A number of cystidia should be observed in order to place a specimen in the proper section.

KEY TO THE SPECIES

1. Cystidia prominent, 50–200 μ long, all alike 2
1. Cystidia scarcely conspicuous, 20–50 μ long, or if longer, then accompanied by small cystidia with incrusted heads 5
   2. Spores 8–12 μ long 3
   2. Spores 4–8 μ long 4
3. Fruiting body usually odontioid, white to cream .... 36. *P. aspera*
3. Fruiting body papillose, ochraceous- to cinnamon-buff ..... 37. *P. subtestacea*
   4. Cystidia colored, not at all to minutely incrusted, 4–5 μ in diameter ..... 38. *P. byssoides*

4. Cystidia hyaline, heavily incrusted, 6–9 μ in diameter ..... 39. *P. polonensis*

5. Cystidia of two distinct types: one cylindrical, flexuous, 40–100 × 4–7 μ, the other acicular to subulate, heavily incrusted around the apex, 20–30 × 2.5–4.5 μ ..... 40. *P. pallidula*

5. Cystidia uniformly conical or cylindrical, 20–50 × 3–7 μ 6

6. Cystidia conical, sharp-pointed, one-septate, staining above the septum, remaining hyaline below ..... 41. *P. vilis*

6. Cystidia cylindrical, not sharp-pointed, one- to many-septate, staining throughout 7

7. Spores 3.5–6 μ long; cystidia 4–6 μ in diameter ..... 42. *P. pusilla*

7. Spores 6–7 μ long; cystidia 3–4 μ in diameter ..... 43. *P. perexigua*

36. *Peniophora aspera* (Pers.) Sacc. Fig. 36

Fl. Ital. Crypt. Hymen., p. 1182. 1916. *Thelephora aspera* Pers., Mycol. Eur. 1:153. 1822. *Peniophora setigera* (Fries) Hoehn. & Litsch. and *Odontia setigera* (Fries) L. W. Miller (*fide* Rogers and Jackson, 1943, p. 283).

Fructifications widely effused, adnate, white to cream, membranous, slightly waxy; surface odontioid, cracking and showing the white subiculum in the fissures; margin pruinose, thinning out.

In section hyaline, up to 500 μ thick; hyphae loosely arranged in the lower two-thirds but compact in the subhymenium, somewhat incrusted toward the hymenium, rather thin-walled, nodose-septate, 3–6 μ in diameter; cystidia few, cylindrical, simple- or nodose-septate, incrusted with coarse granules, immersed or projecting up to 70 μ, 60–200 × 9–12 μ; basidia subclavate, 30–40 × 5–8 μ; spores hyaline, smooth, nonamyloid, subcylindrical, flattened on one side, 8–12 × 3–4.5 μ.

On wood of angiosperms and gymnosperms in New York, Virginia, and Ukraine; reported as widespread in North America and Europe.

The odontioid appearance is due to the projections of tissue about the cystidia. These make the hymenial surface of the sporophore resemble certain species of Odontia.

37. *Peniophora subtestacea* Litsch. Fig. 37

Oesterr. Bot. Zeitschr. 77:132. 1928.

Fructifications widely effused, adnate, "ochraceous-buff" to "cinnamon-buff" (R), membranous; surface minutely papillose, pilose from the projecting cystidia; margin finely fibrillose.

In section hyaline, 100–300 μ thick; hyphae loosely arranged, thin-walled, nodose-septate, 3–5 μ in diameter; cystidia abundant, cylindrical, rather thick-walled, one- to five-septate, often with a clamp connection at the septa, usually coarsely incrusted, projecting up to 50 μ, 50–150 × 7–10 μ; basidia subclavate, 15–25 × 5–7 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 8–12 × 3.5–4.5 μ.

On wood of angiosperms in New York, Ontario, Connecticut, and Austria; reported from Massachusetts, Pennsylvania, Ohio, Iowa, and Sweden.

This species resembles 36. *P. aspera* in its microscopic characters, but differs in having an ochraceous- to cinnamon-buff fructification with a papillose surface, in contrast with a white to cream and odontioid one in *P. aspera*.

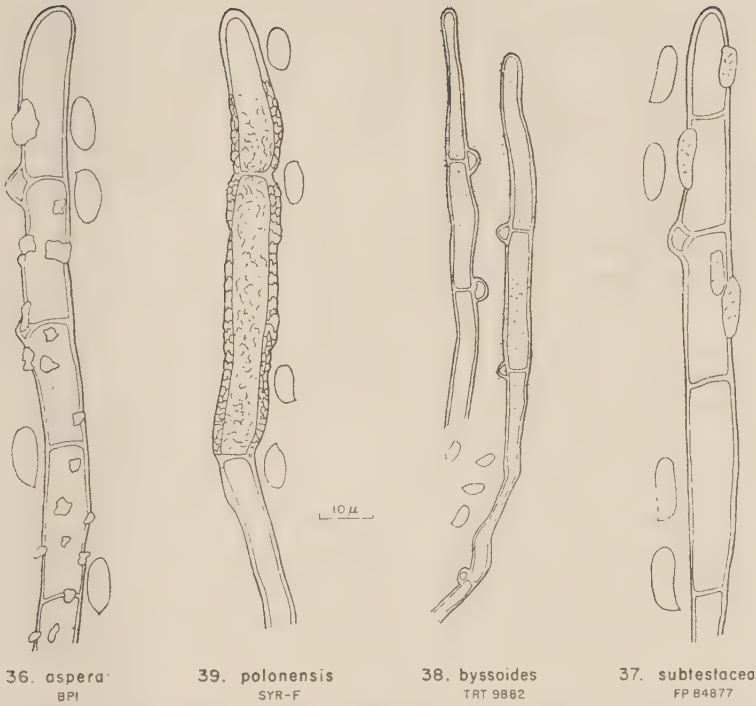
38. *Peniophora byssoides* (Pers. ex Fries) Bres. Fig. 38

In Brinkmann, Westf. Prov.-Ver. Jahresbr. 26:130. 1898. *Thelephora byssoides* Pers. ex Fries, Syst. Myc. 1:452. 1821. *Athelia strigosa β muscigena* Pers., Mycol. Eur. 1:83. 1822. *Peniophora byssoidea* subsp. *tomentella* (Bres.) Bourd. & Galz. (*fide* Rogers and Jackson, 1943, p. 276).

Fructifications widely effused, separable, from cream to pale pinkish, subpelliculose; surface discontinuous, pilose from the projecting cystidia; margin fibrillose.

In section 100–200 μ thick; hyphae loosely arranged in the two-thirds portion next to the substratum, prominent, slightly colored, with rather thin but firm walls, nodose-septate, 3–5 μ in diameter; cystidia abundant, often slightly colored, cylindrical, minutely or not at all incrusted, simple- or more often nodose-septate, projecting up to 75 μ, 50–140 × 4–5 μ; basidia clavate, 20–25 × 4–6 μ; spores hyaline or "citrin clair, paille ambré, subhyalines" (Bourdot and Galzin, 1928, p. 297), smooth, nonamyloid, broadly ellipsoid, 4–6 × 2.5–3 μ.

On wood of angiosperms and gymnosperms in New York, Ontario, Massachusetts, and Vermont; reported as widespread in North America and Europe.



FIGS. 36-39. — Microscopic features of species of Peniophora, all × 750. FIG. 36. Cystidium and spores of *P. aspera*. Drawn from Stevenson coll., Oct. 1939. FIG. 37. Same of *P. subtestacea*. FIG. 38. Same of *P. byssoides*. FIG. 39. Same of *P. polonensis*. Drawn from Brandt coll., Oct. 26, 1956.

The fructification has many of the characteristics of a species of Coniophora but it cannot be assigned to that genus because its spores remain hyaline or are only slightly tinted.

39. *Peniophora polonensis* (Bres.) Hoehn. & Litsch. Fig. 39

Ann. Mycol. 4:292. 1906. *Kneiffia polonensis* Bres., Ann. Mycol. 1:103. 1903. *Peniophora canadensis* Burt (*fide* Rogers and Jackson, 1943, p. 316).

Fructifications effused, adnate, white to cream, floccose; surface discontinuous, pubescent; margin concolorous, thinning out.

In section hyaline, 200–400 μ thick; hyphae loosely arranged, somewhat incrusted in the subhymenium, rather thin-walled, nodose-septate, 4–6 μ in diameter; cystidia very abundant, cylindrical, of

uniform diameter, incrusted, with or without clamp connections, projecting up to 120 μ, originating near the substratum, 90–200 × 6–9 μ; basidia cylindrical, 18–30 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, oblong-ellipsoid, flattened on one side, 6–8.5 × 3.5–5 μ.

On wood of angiosperms and gymnosperms in New York, Ontario, North Carolina, and Poland; reported from Pennsylvania, Connecticut, Michigan, Austria, and France.

P. polonensis should be easy to distinguish from other species with septate cystidia as it has very large cystidia, a distinctly floccose texture, and rather large spores.

40. *Peniophora pallidula* (Bres.) Bres. Fig. 40

In Bourdot & Galzin, Soc. Myc. France Bul. 28:390. 1913. *Gonatobotrys pallidula* Bres., Ann. Mycol. 1:127. 1903. *Peniophora alutaria* Burt and *P. laminata* Burt (*fide* Rogers and Jackson, 1943, p. 313).

Fructifictaions widely effused, adnate, cream to pale brown, usually membranous, sometimes with very scanty subiculum; surface rough, deeply cracking, finely pilose; margin pruinose, thinning out.

In section hyaline, 25–200 μ thick; hyphae irregular, thin-walled, nodose-septate, 2.5–3.5 μ in diameter; cystidia abundant, of very variable shape and of two general types: the one cylindrical, flexuous, with one or few constrictions of the cystidial stem, often capitate or terminating with a button, frequently septate, with or without clamp connections, with thin or somewhat thickened walls, not at all or slightly incrusted, projecting up to 45 μ, 40–100 × 4–7 μ; the other more or less constant in shape, acicular to subulate, heavily incrusted around the apex with strongly refractive granules, 20–30 × 2.5–4.5 μ; basidia variable, mostly subclavate, 15–20 × 3–4.5 μ; spores hyaline, smooth, nonamyloid, of variable shape and size, ellipsoid to oval, flattened on one side or slightly depressed, 4–6 × 2.5–4 μ.

On wood of gymnosperms, rarely on angiosperms, in New York, Ontario, Pennsylvania, Tennessee, and France; reported as widespread in North America and Europe.

The presence of two distinct types of cystidia is diagnostic for this species. This characteristic separates *P. pallidula* from the other species with septate cystidia. The great variability of the cystidia, basidia and spores is worth noting.

41. *Peniophora vilis* Bourd. & Galz. Fig. 41

Hymén. France, p. 282. 1928.

Fructifications somewhat effused, adnate, very inconspicuous, white, pruinose, without substantial subiculum; surface interrupted, minutely pilose; margin indeterminate.

Hyphae very indistinct, thin-walled, nodose-septate, 1–2 μ in diameter; cystidia frequent, occasionally branched, conical, thin-walled, usually one-septate, staining above the septum but remaining hyaline below, projecting up to 35 μ, 40–50 × 5–7 μ; basidia directly attached to the substratum, subclavate, 9–15 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 6–7.5 × 1.5–2.5 μ.

On wood of angiosperms and gymnosperms in Ontario; not yet known from New York; reported from Austria and France.

This is a very delicate plant, scarcely visible to the unaided eye. The main distinguishing characters are the small conical septate cystidia which retain the stain only above their septa, and the cylindrical, curved spores.

42. *Peniophora pusilla* Jacks. Fig. 42
Canad. Jour. Res. 26(C):137. 1948.

Fructifications effused, floccose, separable, white, appearing downy; surface discontinuous; margin indeterminate.

In section hyaline, of indistinct structure; hyphae rather thin-walled, nodose-septate, coarsely incrusted with highly refractive crystals, 3–4 μ in diameter; cystidia numerous, cylindrical, obtuse, projecting for about half of their length, usually clamped, often covered with pointed crystals in the lower part, 30–45 × 4–6 μ; basidia cylindrical to clavate, 7.5–12 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to subglobose, slightly flattened on one side, apiculate, 3.5–5 (–6) × 3–3.5 (–4) μ.

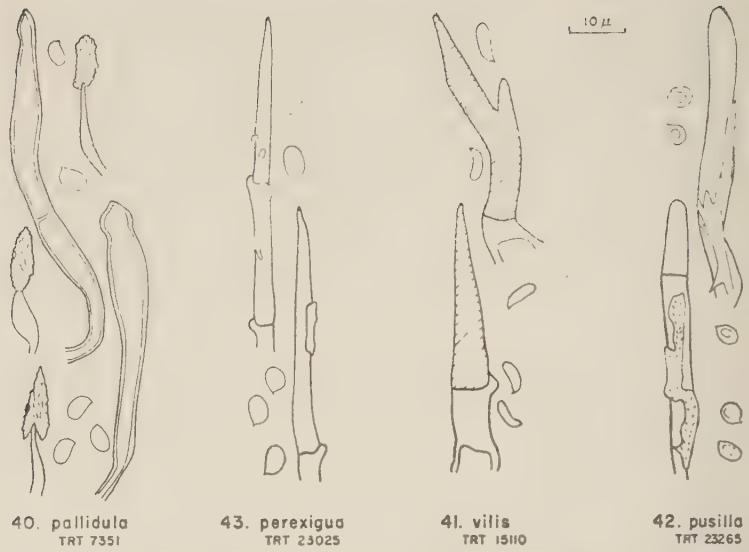
On wood of hemlock in Ontario; not yet known from New York; reported from New Hampshire and Quebec.

This species is similar to 43. *P. perexigua* which differs in having basidia 12–20 μ long, and larger spores, 6–7 × 4–5 μ.

43. *Peniophora perexigua* Jacks. Fig. 43
Canad. Jour. Res. 26(C):132. 1948.

Fructifications somewhat effused, floccose, white, downy in appearance; surface discontinuous; margin indeterminate.

Subiculum composed of irregularly arranged hyphae, with flattened incrustations, thin-walled, nodose-septate, 3–4 μ in diameter; cystidia slender, acuminate, with incrustations similar to those on



Figs. 40-43. — Microscopic features of species of Peniophora, all × 750. Fig. 40. Two types of cystidia, and spores of *P. pallidula*. Fig. 41. Cystidia and spores of *P. vilis*. Diagonal lines indicate the stain-retaining part of the cystidium. Fig. 42. Cystidia and spores of *P. pusilla*. Fig. 43. Same of *P. perexigua*.

hyphae, often clamped or septate, projecting up to 20 μ, 20–45 × 3–4 μ; basidia subclavate, 12–20 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to subglobose, slightly flattened on one side, apiculate, 6–7 × 4–5 μ.

On wood of gymnosperms in Ontario; not yet known from New York.

This species is similar to 42. *P. pusilla* which differs in having basidia 7.5–12 μ long, and smaller spores, 3.5–6 × 3–4 μ.

Section VI

Spores subglobose to globose, nonamyloid, the walls smooth; gloeocystidia absent; cystidia persisting in 10% KOH, nonseptate; hyphae simple- or nodose-septate.

The subglobose to globose spores are a characteristic feature of this section. In most species they are prominently apiculate. The fruiting bodies are often without a substantial subiculum or are not over 100 μ thick (except in 50. *P. laxa* and 49. *P. sublaevis*).

1. Hyphae simple-septate, distinct 2
1. Hyphae nodose-septate, often very indistinct 3
2. Cystidia 75–120 × 7–9 μ; spores 6–8 × 5–6 μ.... 44. *P. lauta*
2. Cystidia 60–70 × 4–5 μ; spores 5 × 6 μ..... 45. *P. ralla*
3. Imperfect stage surrounding the fruiting body.... 46. *P. candida*
3. Imperfect stage absent 4
4. Cystidia conical, heavily incrusted or rough-walled, the longest 120 μ 5
4. Cystidia cylindrical, clavate, or acicular, minutely or not at all incrusted, smooth-walled, the longest 80 μ 6
5. Spores 7–10 × 6–7.5 μ ..... 47. *P. farinosa*
5. Spores 5–7.5 × 4.5–6.5 μ ..... 48. *P. abietis*
6. Spores 3–4.5 × 2.5–3.5 μ ..... 49. *P. sublaevis*
6. Spores 4.5–7 × 4–6 μ 7
7. Fruiting body 100–300 μ thick; basidia ellipsoid to inflated, 18–24 × 7–10 μ ..... 50. *P. laxa*
7. Fruiting body without substantial subiculum; basidia cylindrical, 12–20 × 4–5 μ ..... 51. *P. cymosa*

44. *Peniophora lauta* Jacks. Fig. 44
Canad. Jour. Res. 26(C):129. 1948.

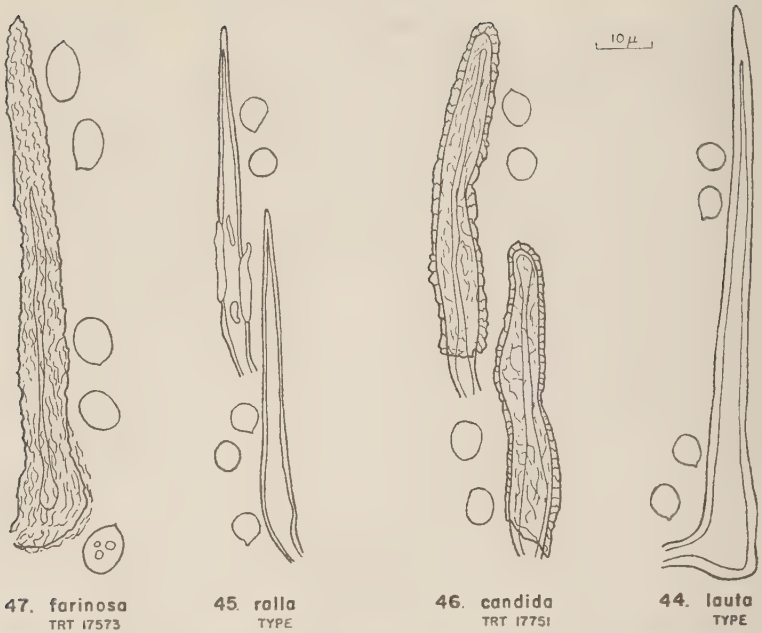
Fructifications somewhat effused, separable, white, without substantial subiculum; surface pruinose, interrupted; margin indeterminate.

Subiculum hyphae scarce, rather thin-walled, simple-septate, 3–4.5 μ in diameter; cystidia abundant, acicular, with thickened walls, not incrusted, projecting for almost their entire length, 75–120 × 7–9 μ; basidia clavate, in clusters, 25–30 × 7–8 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to subglobose, 6–8 × 5–6 μ.

On wood of angiosperms and gymnosperms in Ontario; not yet known from New York; reported from Oregon.

The large acicular cystidia and the simple-septate hyphae are characteristic of this species. The variability of spores between individual specimens is noteworthy.

45. *Peniophora ralla* Jacks. Fig. 45
Canad. Jour. Res. 26(C):136. 1948.



FIGS. 44-47. — Microscopic features of species of Peniophora, all × 750. FIG. 44. Cystidium and spores of *P. lauta*. Drawn from type. FIG. 45. Same of *P. ralla*. Drawn from type. FIG. 46. Same of *P. candida*. FIG. 47. Same of *P. farinosa*.

Fructifications somewhat effused, separable, white, without substantial subiculum; surface pruinose, interrupted; margin indeterminate.

Subiculum hyphae longitudinally arranged, incrusted, thin-walled, simple-septate, 3–4 μ in diameter; cystidia numerous, acicular, occasionally incrusted, projecting for almost their entire length, 60–70 × 4–5 μ; basidia subclavate, often in clusters, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, globose, prominently apiculate, 5–6 μ in diameter.

On bark and wood of *Abies balsamea* (L.) Mill. in Ontario; not yet known from New York.

This species is similar to 44. *P. lauta* which differs in having more prominent cystidia (75–120 × 7–9 μ), and larger spores, 6–8 × 5–6 μ.

46. *Peniophora candida* (Pers. ex Fries) Lyman Fig. 46

Boston Soc. Nat. Hist. Proc. 33:167. 1907. *Aegerita candida* Pers., Roemer's Neues Mag. Bot. 1:120. 1794; Fries, Syst. Myc. 3:220. 1829. *Peniophora aegerita* Hoehn. & Litsch. (*fide* Rogers *in litt.*)

Fructifications somewhat effused, adnate, white to cream, membranous; surface farinose, often rugulose; margin thinning out. Small, globose, white to golden structures ("imperfect stage," *Aegerita candida* according to Burt, 1926a, p. 226) adjoin the margin.

In section hyaline, with abundant crystals in the subhymenium, up to 100 μ thick; hyphae obscure, often of short, irregular cells, collapsing, thin-walled, rarely nodose-septate, 2–4 μ in diameter; cystidia from rare to few, cylindrical, rounded to acuminate, thick-walled, heavily incrusted, projecting up to 40 μ, 50–80 × 6–10 μ; basidia clavate, 25–35 × 6–8 μ; spores hyaline, smooth, nonamyloid, subglobose to globose, 6–7.5 × 5–6.5 μ.

On wood of angiosperms in New York and Ontario; reported as widespread in North America and Europe.

The species is readily recognized by the unique imperfect stage adjoining the margin of the fruiting body. See also note under 47. *P. farinosa*.

47. *Peniophora farinosa* (Bres.) Hoehn. & Litsch. Fig. 47
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 117 (Abt. 1):1095. 1908. *Kneiffia farinosa* Bres., Ann. Mycol. 1:105. 1903.

Fructifications somewhat effused, adnate, white, submembranous; surface often interrupted, pilose from the projecting cystidia; margin pruinose, thinning out.

In section hyaline, with abundant crystals in the subhymenium, up to 100 μ thick; hyphae indistinct, fragmenting in section, thin-walled, rarely nodose-septate, 3–4 μ in diameter; cystidia abundant, cylindrical or conical, slightly vesiculose at the base, thick-walled, heavily incrusted, projecting up to 60 μ, 50–100 × 7–12 μ; basidia subclavate, 25–30 × 6–7.5 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to subglose, flattened on one side, apiculate, 7–10 × 6–7.5 μ.

On wood of gymnosperms in Ontario; not yet known from New York; reported from Poland.

The identity of this species is in some doubt. The type is not cited by Bresadola; one of the original specimens on Ulmus studied by Jackson is *P. candida* (herbarium note). Burt (1926a, p. 226) considers *P. farinosa* a synonym of *P. candida*. The specimens named *P. farinosa* by Jackson (TRT 14378, 17573) differ from material labeled *P. candida* in having larger spores and in lacking the imperfect stage. These differences appear sufficient to warrant maintaining *P. farinosa* as a valid species until the type specimen can be found and studied.

48. *Peniophora abietis* Bourd. & Galz. Fig. 48
Soc. Myc. France Bul. 28:383. 1913.

Fructifications somewhat effused, adnate, white, floccose; surface pilose from the projecting cystidia; margin thinning out.

In section hyaline, up to 50 μ thick; hyphae difficult to distinguish, thin-walled, nodose-septate, 2.5–4.5 μ in diameter; cystidia abundant, conical, thin- to thick- and rough-walled, rounded and slightly amyloid at the base, projecting for almost their entire length, 70–120 × 9–15 μ; basidia constricted at the middle, 9–16 × 5–7 μ; spores hyaline, smooth or occasionally slightly echinulate, nonamyloid, subglobose to globose, apiculate, 5–7.5 × 4.5–6.5 μ.

On wood of angiosperms in New York and Ontario; reported from France.

P. abietis can be readily distinguished from the other species with globose spores by its prominent, rough-walled cystidia. The New York collection (Slysh 285) was identified by Weresub, and is probably the first record from the state.

49. *Peniophora sublaevis* (Bres.) Hoehn. & Litsch. Fig. 49
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 117 (Abt. 1):1088. 1908. *Corticium sublaeve* Bres., Ann. Mycol. 1:95. 1903.

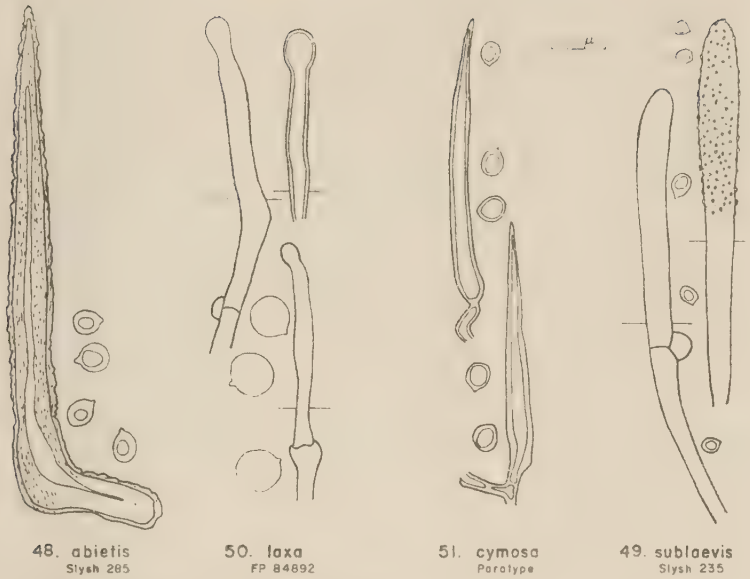
Fructifications widely effused, more or less separable, white to cream, pelliculose, delicate and fragile, sometimes waxy when young according to Hoehnel and Litschauer; surface often cracking, finely pilose; margin fibrillose.

In section hyaline, 100–200 μ thick; hyphae loosely arranged, thin-walled, nodose-septate, 2–3.5 μ in diameter; cystidia rare to numerous, cylindrical to clavate, usually very finely incrusted, sometimes septate below the hymenial layer, with or without clamp connection, projecting up to 50 μ, 50–70 × 5–8 μ; basidia narrowly clavate, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, subglobose to globose, prominently apiculate, 3–4.5 × 2.5–3.5 μ.

On wood of angiosperms and gymnosperms in New York, Ontario, and France; reported from Poland, Austria, and Sweden.

The minute spores of *P. sublaevis* are the smallest found in the species considered in this manual, and they characterize this species.

50. *Peniophora laxa* Burt Fig. 50
Mo. Bot. Gard. Ann. 12:224. 1926.



Figs. 48-51. — Microscopic features of species of Peniophora, all × 750. Fig. 48. Cystidium and spores of *P. abietis*. Fig. 49. Same of *P. sublaevis*. Fig. 50. Same of *P. laxa*. Fig. 51. Same of *P. cymosa*. Drawn from paratype.

Fructifications widely effused, separable, white to cream, pelliculose; surface even, farinose; margin fibrillose, forming mycelial strands.

In section hyaline, with abundant crystals scattered throughout, 100–300 μ thick; hyphae loosely arranged in the lower two-thirds, becoming compact toward the hymenium, somewhat incrusted, thin-walled, nodose-septate, 1.5–3 μ in diameter; cystidia few, cylindrical, often with an apical bulb 6–8 μ in diameter, projecting up to 35 μ, 45–70 × 4–5 μ; basidia ellipsoid to inflated, 18–24 × 7–10 μ; spores hyaline, smooth, nonamyloid, globose, with a prominent apiculus, 5–7 μ in diameter.

On wood of gymnosperms in Connecticut; not yet known from New York; reported from British Columbia.

The most distinctive characters of this species are its pelliculose texture, large globose spores, and ellipsoid to often inflated basidia.

51. *Peniophora cymosa* Rog. & Jacks. Fig. 51
Canad. Jour. Res. 26(C):133. 1948.

Fructifications somewhat effused, delicate, adnate, grayish, without substantial subiculum; surface discontinuous, pilose from the projecting cystidia; margin indeterminate.

Hyphae short-celled, thin- to rather thin-walled, nodose-septate, branching cymosely and giving rise to basidia and cystidia, 3–5 μ or "3–4.5–7.5 μ" (Jackson, 1948, p. 133) in diameter; cystidia very abundant, acicular to narrowly subulate, sometimes somewhat curved, thick-walled, projecting up to 40 μ, 40–80 × 3–6 μ; basidia cylindrical, 12–20 × 4–5 μ; spores hyaline, smooth, rather thick-walled, nonamyloid, subglobose to globose, minutely apiculate, 4.5–6 × 4–5 μ.

On wood of gymnosperms in New York and Ontario; reported from North Carolina.

The distinguishing characters of this species are its short-celled hyphae, thick-walled and narrowly subulate cystidia, and rather thick-walled spores.

Section VII

Hyphae typically simple-septate, with occasional clamp connections at some septa; spores nonamyloid with smooth walls, cylindrical to ellipsoid; gloeocystidia absent; cystidia persisting in 10% KOH, nonseptate.

This section is distinguished by the combination of characters given above. Careful study of the hyphae is necessary to place a specimen in the proper section. A vertically cut preparation is essential for identification. Many of the species have clamp connections as well as simple septa. The comparative ratio of simple to nodose septa is very variable between species and between specimens of the same species. A number of species in this section show a high degree of variation in the color of their fructifications, and in their cystidia, basidia, and spores as well, for example 65. *P. cremea,* 66. *P. affinis,* 54. *P. sanguinea,* and 67. *P. velutina.* It is often difficult to identify a specimen with certainty.

Jackson (1948) attempted to explain the variability of those species with simple-septate hyphae. He suspected that they were homothallic, and as such, would develop a number of homozygous lines showing discontinuous variation. In contrast, the variations in heterothallic species would be less distinctly defined. The group is in need of detailed study.

1. Fruiting body horny to parchment-like on drying. 52. *P. gigantea*
1. Fruiting body distinctly pelliculose 2
1. Fruiting body membranous or waxy 5
   2. Spores 8–10.5 μ long; mycelial strands absent. . 53. *P. viticola*
   2. Spores 3.5–6 μ long; mycelial strands present 3
3. Fruiting body red to salmon; wood often staining red ..... 54. *P. sanguinea*
3. Fruiting body yellow; color of wood not affected 4
   4. Most cystidia heavily incrusted; subiculum hyphae yellow ..... 55. *P. sulphurina*
   4. Cystidia not at all incrusted; subiculum hyphae white ..... 56. *P. burtii*
5. Cystidia thick-walled, heavily incrusted, the largest 12–18 μ in diameter 6
5. Cystidia thin- to rather thick-walled, not at all to moderately incrusted, the largest 5–12 μ in diameter 10
   6. Cystidia arranged in tiers ..... 57. *P. roumeguerii*
   6. Cystidia not arranged in tiers 7
7. Fruiting body brown; hyphae heavily incrusted ..... 58. *P. coccineo-fulva*
7. Fruiting body cream to pinkish; hyphae not incrusted 8
   8. In section hyaline; texture membranous. . 59. *P. flavido-alba*
   8. In section colored; texture waxy 9
9. Surface tubercular, Phlebia-like; in section yellowish throughout; cystidia 9–15 μ in diameter ..... 60. *P. martiana*
9. Surface even; in section hyaline in the hymenial area, pale orange below; cystidia 12–18 μ in diameter ..... 61. *P. farlowii*
   10. Mycelial strands present ..... 62. *P. filamentosa*
   10. Mycelial strands absent 11
11. Cystidia subulate, 7.5–10 μ in diameter; fruiting body cream; hyphae of short swollen segments. . . 63. *P. terricola*
11. Cystidia hyphoid, 3–5 μ in diameter; fruiting body distinctly yellow; hyphae of ordinary type. . . 64. *P. carnosa*
11. Cystidia cylindrical to fusiform, prominent, 4–12 μ in diameter; fruiting body of various colors but never yellow; hyphae of ordinary type 12
    12. Hyphae loosely arranged next to the substratum, rather thick-walled, branching

with wide angles, becoming incrusted toward the hymenium; surface abundantly cracking, showing a shiny subiculum.....65. *P. cremea*

12. Hyphae uniformily arranged, rather thin-walled; surface not at all or rarely cracking.....13

13. Hymenium usually light-colored; surface pruinose; spores subcylindrical to ellipsoid .....66. *P. affinis*

13. Hymenium usually dark-colored; surface hispid; spores ellipsoid .....67. *P. velutina*

52. *Peniophora gigantea* (Fries) Massee Fig. 52

Linn. Soc. Jour. Bot. 25:142. 1889. *Thelophora gigantea* Fries, Syst. Myc. 1:448. 1821. *P. globifera* Ell. & Everh. (*fide* Rogers and Jackson, 1943, p. 317).

Fructifications widely effused, separable, pinkish-buff or marble-gray, waxy, on drying horny and parchment-like; surface usually minutely pilose; margin radiately fibrillose.

In section hyaline or slightly yellowish, 200–600 μ thick; hyphae compactly and longitudinally arranged in the lower part, then ascending, heavily gelatinized, distinct, thick-walled, simple-septate, 3–6 μ in diameter; cystidia infrequent, fusiform, thick-walled, incrusted, immersed or projecting up to 30 μ, 40–60 × 10–12 μ; basidia subclavate, 15–24 × 3.5–4.5 μ; spores hyaline, smooth, nonamyloid, subcylindrical, flattened on one side, 4–5.5 (–7) × 2–3 (–3.5) μ.

On wood and bark of gymnosperms in New York, Massachusetts, Maryland, North Carolina, Michigan, British Columbia, Brazil, Italy, and Ukraine; reported as widespread in North America, Europe, and southern Asia.

This species is easily recognized by its occurrence on wood and bark of gymnosperms (notably on species of Pinus, Abies, and Tsuga), and by its pinkish-buff, horny fructifications.

Bourdot and Galzin (1928, p. 318) report rare clamp connections on the hyphae. They were not observed in the specimens examined.

53. *Peniophora viticola* (Schw.) Hoehn. & Litsch. Fig. 53

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 116 (Abt. 1):779. 1907. *Thelephora viticola* Schw., Leipzig Naturforsch. Ges. Schrift. 1:107. 1822.

Fructifications effused, more or less adnate, pelliculose; surface pruinose, cream to pale gray; margin wide, bright orange, fibrillose.

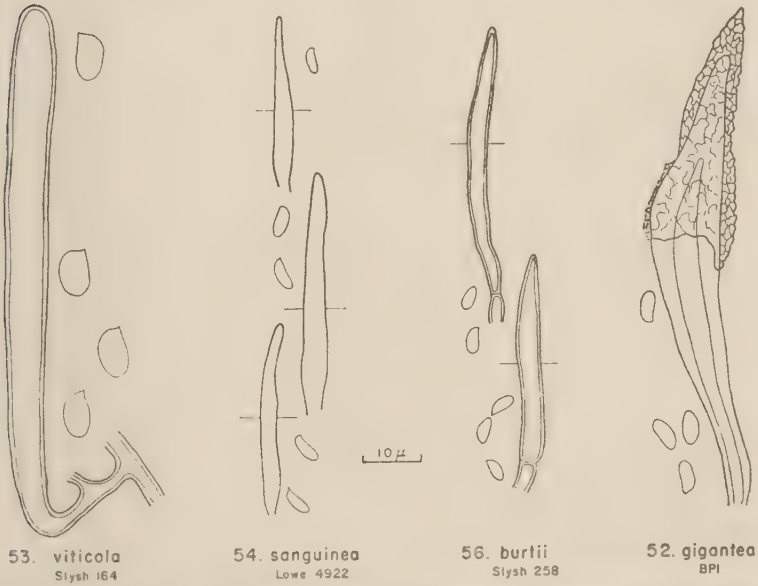
In section orange to yellow, 200–400 μ thick; hyphae loosely arranged, somewhat incrusted, thin-walled, simple-septate, 2–4 μ in diameter; cystidia few, cylindrical, not incrusted, with slightly thickened walls, somewhat flexuous, obtuse, projecting up to 70 μ, 50–90 × 7–10 μ; basidia clavate, 25–40 × 6–9 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid, apiculate, flattened on one side, 8–10.5 × 4–6 μ.

On wood of angiosperms and gymnosperms in New York, Vermont, New Hampshire, and Tennessee; reported as widespread in eastern North America.

The bright orange margin and grayish, pruinose hymenium are very distinctive for this species. No. 60. *P. martiana* is somewhat similar externally, but differs in having smaller spores (4.5–6 × 2–3 μ), and waxy texture.

54. *Peniophora sanguinea* (Fries) Hoehn. & Litsch. Fig. 54

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1588. 1906. *Thelephora sanguinea* Fries, Elench. Fung. 1:203. 1828. *Penio-*



Figs. 52-54 and 56. — Microscopic features of species of Peniophora, all × 750. Fig. 52. Cystidium and spores of *P. gigantea*. Drawn from Bresadola coll., Oct. 1903. Fig. 53. Same of *P. viticola*. Fig. 54. Same of *P. sanguinea*. Fig. 56. Same of *P. burtii*.

phora limonia Burt and *P. miniata* (Berk.) Burt (*fide* Rogers and Jackson, 1943, p. 319).

Fructifications widely effused, separable, variable in color, cream through salmon to red, pelliculose; surface farinose, cracking and exposing the usually colored, floccose subiculum; margin fibrillose, often with mycelial strands; staining the woody substratum red.

In section hyaline, 200–500 μ thick; hyphae loosely arranged, from unincrusted to heavily incrusted, thin-walled, usually simple-septate, 3–6 (–7.5) μ in diameter; cystidia few, fusiform, thin-walled, not incrusted, projecting up to 25 μ, 30–50 × 3–5 μ; basidia cylindrical to clavate, 16–22 × 4–6 μ; spores hyaline, smooth, nonamyloid, oblong-ellipsoid, flattened on one side, 3.5–5 (–6) × 2–2.5 (–3) μ.

Usually on wood of gymnosperms or rarely of angiosperms in New York, Ontario, New Hampshire, Louisiana, New Mexico, Germany, Austria, and Hungary; reported as widespread in North America and Europe.

The specimens with salmon or red hymenial surface are easy to identify. The red-stained substratum, if present, also helps in identification. *P. sanguinea* shows a wide degree of variation and is in need of detailed study.

55. *Peniophora sulphurina* (Karst.) Hoehn. & Litsch. Fig. 55

K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1573. 1906. *Tomentella sulphurina* Karst., Finl. Nat. Folk Bidr. 48:420. 1889.

Fructifications widely effused, separable, from sulphur-yellow to chestnut brown, pelliculose; surface pruinose, sometimes cracking and showing the sulphur-yellow subiculum in the fissures; margin fibrillose, forming mycelial strands.

In section pale yellow, 200–400 μ thick; hyphae loosely arranged below, somewhat incrusted, thin-walled, nodose- or rarely simple-septate, 4–7 μ in diameter; cystidia scattered, difficult to find, subfusiform to cylindrical, heavily incrusted and immersed, or rarely unincrusted and projecting up to 30 μ, 40–60 × 5–9 μ; basidia narrowly clavate, 25–30 × 4–6 μ; spores hyaline, smooth, nonamyloid, ellipsoid, flattened on one side, 4.5–6 × 2.5–3 μ.

On wood of gymnosperms in New York, Ontario, and Finland; reported as widespread in the United States, France, Sweden, and in India.

The sulphur-yellow color of the hymenial surface and of the subiculum is diagnostic. Darker specimens which are apt to be confused

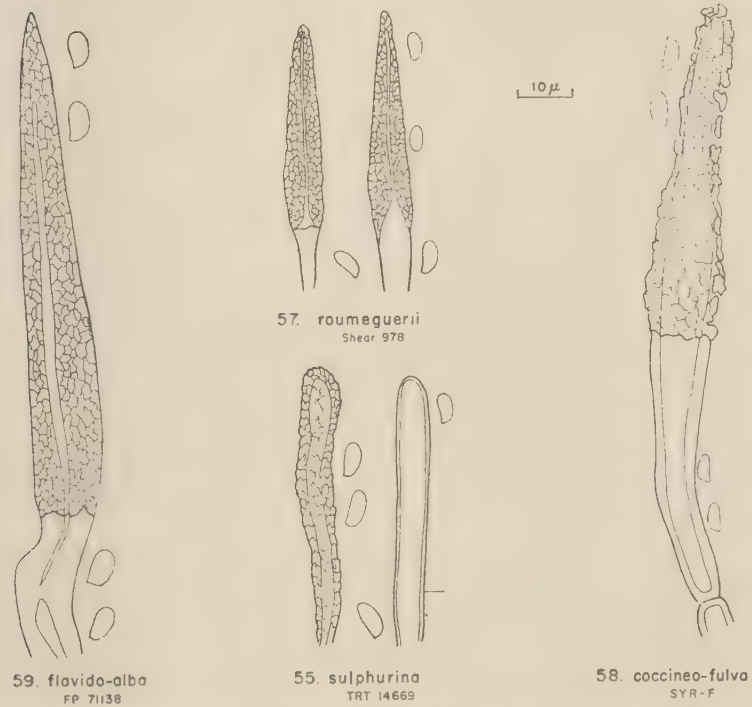
with 62. *P. filamentosa* can be separated by the absence of a color reaction of the hymenium with KOH. In *P. filamentosa* the color of the hymenium changes to wine-red.

56. *Peniophora burtii* Romell — Fig. 56

In Burt, Mo. Bot. Gard. Ann. 12:278. 1926.

Fructifications widely effused, separable, yellowish, pelliculose; surface pruinose, cracked; margin fibrillose, the adjacent fructifications connected by yellow mycelial strands.

In section hyaline or pale yellowish in the upper half of the context, 200–300 μ thick; hyphae loosely arranged in the lower part, becoming compacted and somewhat to abundantly incrusted with brownish granules in the subhymenium, thin-walled, simple-septate, conspicuously constricted at the septa, occasionally nodose-septate



Figs. 55 and 57-59. — Microscopic features of species of Peniophora, all × 750. Fig. 55. Cystidia and spores of *P. sulphurina*. Fig. 57. Same of *P. roumeguerii*. Fig. 58. Same of *P. coccineo-fulva*. Drawn from Weir coll., Bresadola det. Fig. 59. Same of *P. flavido-alba*.

and the clamps often double, 4–8 (–10) μ in diameter; cystidia rare to frequent, hyphoid or fusiform, with slightly thickened walls, not incrusted, projecting up to 30 μ, 30–40 × 3–5 μ; basidia clavate, 20–30 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, elongate-ellipsoid, flattened on one side, apiculate, 4–5 × 2–2.5 μ.

On wood of angiosperms in New York, Ontario, and West Virginia; reported from "Vermont to Louisiana and in Ohio, Michigan, and Montana" (Burt).

This species is characterized by its yellow mycelial strands, its hyphal constrictions, and its delicate cystidia. There are no other species in this manual with which it is likely to be confused. Specimens with rare cystidia which have been overlooked may be mistaken for *Corticium sulphureum* Fries, "which has yellower fructifications and not as large mycelial cords . . ." (Burt).

57. *Peniophora roumeguerii* (Bres.) Hoehn. & Litsch. Fig. 57
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1581. 1906. *Corticium roumeguerii* Bres., Fung. Trid. 2:36. 1892.

Fructifications widely effused, adnate, cream to pinkish-cream, rigid, membranous; surface distinctly pilose from the projecting cystidia, often cracking; margin pruinose.

In section hyaline, layered in thicker specimens, 150–600 μ thick; hyphae interwoven and difficult to distinguish, rather thin-walled, simple-septate, 2–3.5 μ in diameter; cystidia very abundant, conical to fusiform, thick-walled, heavily incrusted, immersed at all levels and arranged in tiers or projecting up to 60 μ, 40–60 (–80) × 8–12 (–15) μ; basidia subclavate, 15–25 × 3–4.5 μ; spores hyaline, smooth, nonamyloid, oblong-ellipsoid, 4.5–6.5 × 2.5–3.5 μ.

On wood of angiosperms in Georgia, Louisiana and Pennsylvania; not yet known from New York; reported from southern United States and the West Indies, from Montana and the West Coast, and from Europe.

The species is characterized by the unique arrangement of abundant cystidia in tiers.

58. *Peniophora coccineo-fulva* (Schw.) Burt Fig. 58
Mo. Bot. Gard. Ann. 12:253. 1926. *Phlebia coccineo-fulva* Schw., Amer. Phil. Soc. Trans., II, 4:165. 1832. *Peniophora rhodochroa* Bres., Mycologia 17:70. 1925.

Fructifications widely effused, adnate, "russet" to "natal brown"

(R), membranous, becoming waxy-fragile; surface often cracking, pilose; margin paler, radiately fibrillose.

In section hyaline or somewhat pinkish in the hymenial area, 100–400 μ thick; hyphae loosely arranged in the lower two-thirds and compact in the upper third, heavily incrusted, rather thick-walled, simple-septate, often swollen at the septa, 4–10 μ in diameter; cystidia abundant, cylindrical, tapering toward the apex, or subfusiform, thick-walled, usually heavily incrusted, projecting up to 45 μ, 50–100 × 10–14 μ; basidia narrowly clavate, 22–30 × 5–7 μ; spores hyaline, smooth, nonamyloid, oblong-ellipsoid, flattened on one side, 5–7 × 2.5–3.5 μ.

On wood of angiosperms and gymnosperms in Ontario, Virginia, Idaho, and Sweden; reported as widespread in North America and Europe.

This species is similar to 67. *P. velutina* which differs in having nonincrusted hyphae and a somewhat lighter color of the fructification.

59. *Peniophora flavido-alba* Cooke Fig. 59
Grevillea 8:21. 1879.

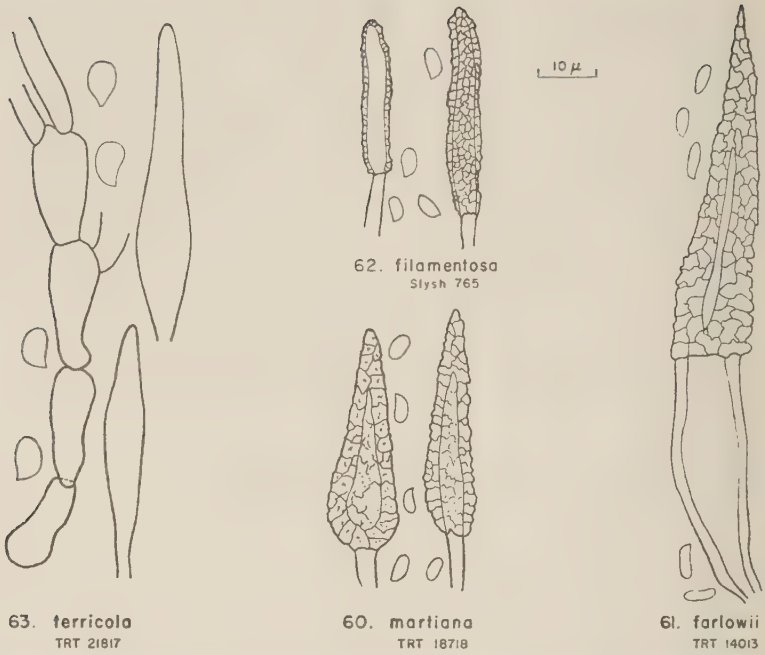
Fructifications widely effused, adnate, cream to tan, membranous, firm; surface distinctly pilose, cracking; margin indeterminate.

In section hyaline, 150–300 μ thick; hyphae compactly arranged, difficult to separate, rather thin-walled, simple-septate, 2.5–4 μ in diameter; cystidia very abundant, conical or fusiform, thick-walled, heavily incrusted, somewhat tilted, immersed or projecting up to 50 μ, 60–120 × 7–16 μ; basidia clavate, 15–20 × 6–8 μ; spores hyaline, smooth, nonamyloid, ellipsoid, flattened on one side, 4.5–6.5 × 2.5–4 μ.

On wood of angiosperms in New York, Puerto Rico, and Brazil; reported as widespread in eastern North America and the West Indies.

No. 57. *P. roumeguerii* is almost identical except for its more abundant and smaller cystidia (40–80 × 8–15 μ) arranged in tiers. No. 21. *P. pubera* and 70. *P. guttulifera* are also similar, but differ principally in having nodose-septate hyphae and, in addition, *P. pubera* has gloeocystidia.

60. *Peniophora martiana* (Berk. & Curt.) Burt Fig. 60
Mo. Bot. Gard. Ann. 12:330. 1926. *Corticium martianum* Berk. & Curt., Grevillea 1:179. 1873.



FIGS. 60-63. — Microscopic features of species of Peniophora, all × 750. FIG. 60. Cystidia and spores of *P. martiana*. FIG. 61. Same of *P. farlowii*. FIG. 62. Same of *P. filamentosa*. FIG. 63. Cystidia, spores, and hyphae of *P. terricola*.

Fructifications widely effused, adnate, cinnamon to pinkish, waxy; surface minutely pilose, becoming somewhat tubercular; margin radiately fibrillose, paler.

In section yellowish, 150–400 μ thick, two-layered; context hyphae in lower portion longitudinally arranged, yellowish in mass, very compact, thin-walled, simple-septate, 2–4 μ in diameter, becoming erect, loosely arranged, incrusted and with much surrounding granular matter, fragmenting on crushing, 3–6 μ in diameter; cystidia abundant, conical, thick-walled, heavily incrusted, projecting up to 30 μ, 30–80 × 9–15 μ; basidia clavate, 20–25 × 3–4.5 μ; spores hyaline, smooth, nonamyloid, cylindrical to ellipsoid, flattened on one side, apiculate, 4.5–6 × 2–3 μ.

On wood of angiosperms (noted on birch and poplar), in New York, Ontario, and Idaho; reported as widespread in North America.

On superficial examination this species can be confused with 53. *P. viticola* which differs in its larger spores (8–10.5 × 4–6 μ) and its pelliculose texture. The texture and hymenial surface of *P. martiana* are similar to those of species of Phlebia.

61. *Peniophora farlowii* Burt Fig. 61

Mo. Bot. Gard. Ann. 12:343. 1926.

Fructifications somewhat effused, closely adnate, cream, waxy, with a distinct dark layer next to the substratum; surface pilose, cracking; margin thinning out.

In section hyaline in the hymenial area, pale orange below, 200–500 μ thick; hyphae difficult to separate, compact and coherent, thin-walled, simple-septate, occasionally nodose-septate as well, 2–2.5 μ in diameter; cystidia abundant, very prominent, conical, thick-walled, heavily incrusted, projecting up to 45 μ, 50–75 × 12–18 μ; basidia clavate, 20–25 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 4.5–6.5 × 2–2.5 μ.

On wood of angiosperms in Ontario and New Hampshire; not yet known from New York.

This species is readily recognized by its extremely prominent cystidia, and by the cartilaginous, brown-black lower layer of the fructification. Burt, in the orginal description, gives the size of the spores as 4 × 2 μ. The great majority of the spores in the type collection (at Farlow Herb.) measure 4.5–6.5 × 2–2.5 μ. There is an annotation by Burt on the package giving the size as "6–7 × 3 μ" which has been crossed out and changed to "4 × 2" μ.

62. *Peniophora filamentosa* (Berk. & Curt.) Burt Fig. 62

In Coker, Elisha Mitchell Sci. Soc. Jour. 36:162. 1921. *Corticium filamentosum* Berk. & Curt., Grevillea 1:178. 1873.

Fructifications widely effused, separable, pale rusty brown, submembranous; surface minutely pilose, turning wine-red upon application of KOH; margin paler, often extending into branching mycelial strands.

In section ferruginous to hyaline, 200–400 μ thick; hyphae vertically and loosely arranged, branching with wide angles, incrusted with brownish granules which dissolve quickly in KOH, thin-walled, simple-septate, 3–6 μ in diameter; cystidia abundant, cylindrical or fusiform, incrusted, projecting for almost their entire length, 30–50 × 7–12 μ; basidia subclavate, 15–25 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, oblong to ellipsoid, flattened on one side, 4–5.5 × 2–3 μ.

On wood of angiosperms in New York, Arkansas, and Alabama; reported as widespread in North America, Europe, South Africa, Japan, and New Zealand.

P. filamentosa is a distinctive species characterized by its widely branching, incrusted hyphae, and its rhizomorphic margin. No. 65. *P. cremea* is somewhat similar microscopically but differs macroscopically in the absence of mycelial strands.

63. *Peniophora terricola* Burt Fig. 63
Mo. Bot. Gard. Ann. 12:237. 1926.

Fructifications effused, adnate, cream, membranous, rigid when dry; surface even, somewhat cracking; margin thinning out and pruinose or radiately fibrillose in some areas.

In section hyaline, 150–200 μ thick; hyphae compactly and vertically arranged, of often swollen, short segments (up to 12 μ in diameter), thin-walled, simple-septate or with obscure clamps, 3–12 μ in diameter; cystidia few, subulate, thin-walled, not incrusted, projecting up to 50 μ, 60–80 × 7.5–10 μ; basidia cylindrical, 25–40 × 5–7.5 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to turbinate, apiculate, flattened on one side or curved, 6–8 × 4–5 μ.

On soil (type specimen) and on the bark of hemlock in New York and Ontario; reported from Louisiana.

The distinctive characteristics of this species are its subulate cystidia, broadly ellipsoid to turbinate spores, and its peculiar hyphae, consisting of short, swollen segments. The species is not limited to a soil substratum.

64. *Peniophora carnosa* Burt Fig. 64
Mo. Bot. Gard. Ann. 12:325. 1926.

Fructifications widely effused, adnate, yellow ("barium-yellow to honey-yellow," Burt), membranous; surface slightly cracking and showing the concolorous subiculum, pruinose; margin determinate or minutely fibrillose.

In section pale yellowish, 200–800 μ thick, sometimes with distinct layering; hyphae longitudinally and loosely arranged in the lower part, then ascending, occasionally to heavily incrusted, thin- to rather thin-walled, simple-septate, 4–8 μ in diameter; cystidia abundant, hyphoid, cylindrical, usually tapering toward the tip, thin-walled, not incrusted, projecting up to 30 μ, 45–60 × 3–5 μ; basidia subclavate, 25–45 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, oblong to ellipsoid, apiculate, usually flattened on one side, 4–5 × 2–2.5 μ.

On wood of gymnosperms or rarely on angiosperms in New York, Ontario, Massachusetts, and Idaho; reported from Maine, New

Hampshire, New Mexico, Minnesota, Montana, British Columbia, Washington, and South Africa.

P. carnosa is one of the largest and thickest of the species of Peniophora. No. 55. *P. sulphurina* is similar, but differs in having much thinner and less extensive, separable fructifications, and in having rare, heavily incrusted cystidia.

65. *Peniophora cremea* (Bres.) Sacc. & Syd. Fig. 65

Syll. Fung. 16:195. 1902. *Corticium cremeum* Bres., Fung. Trid. 2:63. 1898. *Peniophora sordida* (Karst.) Hoehn. & Litsch., *P. eichleriana* (Bres.) Bourd. & Galz., and *P. arachnoidea* Burt (*fide* Rogers and Jackson, 1943, p. 314).

Fructifictaions widely effused, separable, pale-cream to ochraceous, submembranous, cracking much on drying and exposing in the fissures a shiny subiculum of radiate fibers; surface minutely pilose; margin white, fibrillose.

In section hyaline, 100–400 μ thick, loosely arranged in the lower two-thirds, becoming compact and incrusted toward the hymenium; hyphae vertically arranged, branching repeatedly with wide angles, rather thick-walled, simple-septate, 4–7.5 μ in diameter; cystidia abundant, cylindrical and obtuse or fusiform and acuminate, rather thin-walled, finely incrusted or not incrusted, immersed or projecting up to 60 μ, 45–100 × 5–8 μ; basidia subclavate, 20–30 × 4–6 μ; spores hyaline, smooth, nonamyloid, cylindrical to ellipsoid, flattened on one side, 5–7.5 × 2.5–3.5 μ.

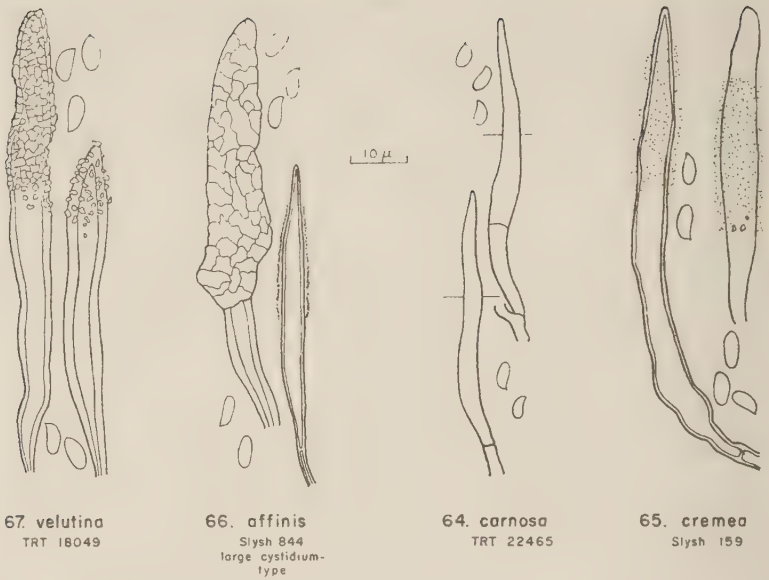
On wood of angiosperms and gymnosperms in New York, Idaho, and Washington; reported from throughout Europe, North America, Japan, New Zealand, and South Africa.

P. cremea is very abundant in New York. It is a well-defined species characterized by its two-layered, abundantly cracking fructification, and by its rather thick-walled, widely branching hyphae, which become compact and incrusted toward the hymenium.

66. *Peniophora affinis* Burt Fig. 66

Mo. Bot. Gard. Ann. 12:266. 1926. *P. laevis* sense of Burt, and *P. laevis* var. *affinis* (Burt) Litsch. (*fide* Rogers and Jackson, 1943, p. 318).

Fructifications widely effused, separable, cream with pinkish tint to light pinkish-cinnamon, membranous, with the hymenial layer becoming somewhat waxy on drying; surface pruinose, or minutely



Figs. 64-67. — Microscopic features of species of Peniophora, all × 750. Fig. 64. Cystidia and spores of *P. carnosa*. Fig. 65. Same of *P. cremea*. Fig. 66. Same of *P. affinis*. Large cystidium drawn from type (in FH). Fig. 67. Same of *P. velutina*.

pilose in side view, occasionally cracking; margin white, radiately fibrillose.

In section hyaline, 300–700 μ thick; hyphae longitudinally arranged in the layer next to the substratum, then ascending, of more or less uniform compactness throughout, thin- to rather thin-walled, generally simple-septate, but occasionally with prominent clamps, 3–9 μ in diameter; cystidia abundant, subfusiform to fusiform, rather thin-walled, heavily to slightly or not at all incrusted, immersed and confined to the subhymenial layer, or projecting up to 40 μ, 30–60 × 4–8 μ; basidia subclavate, 15–25 × 4–6 μ; spores hyaline, smooth, nonamyloid, subcylindrical to ellipsoid, flattened on one side, 5–7 × 2.5–3 μ.

On wood of angiosperms in New York, France, Sweden, and Ukraine; reported as widespread in North America and Europe.

No. 67. *P. velutina* is a very similar species which can be distinguished only with difficulty. The microscopic differences are negligible and the macroscopic characters are unstable. As a rule, *P. velutina* has a darker colored and hispid hymenium, and slightly wider spores. Additional criteria are needed to separate these species with certainty.

67. *Peniophora velutina* (DC ex Fries) Cooke Fig. 67

Grevillea 8:21. 1879. *Thelephora ? velutina* DC, Fl. Franc. 6:33. 1815; Fries, Elench. Fung. 1:203. 1828.

Fructifications widely effused, adnate, usually "vinaceous-buff" (R) but occasionally cream colored, membranous; surface hispid; margin radiately fibrillose.

In section slightly colored, 250–500 μ thick; hyphae more or less loosely arranged, thin-walled, simple-septate, 4–10 μ in diameter; cystidia abundant, cylindrical to subclavate, thin- to rather thick-walled, heavily or slightly incrusted, immersed or projecting up to two-thirds of their entire length, 50–120 × 8–12 μ; basidia subclavate, 20–35 × 5–7 μ; spores hyaline, smooth, nonamyloid, ellipsoid, flattened on one side, 5–7 × 2.5–3.5 μ.

On wood of angiosperms or rarely of gymnosperms in New York, Ontario, Nova Scotia, Idaho, British Columbia, Italy, Ukraine, and Latvia; reported from "throughout Canada and the United States and in Europe" (Burt, 1926a, p. 264), and South Africa.

No. 66. *P. affinis* is similar and is often scarcely distinguishable from this species. It differs usually in having a lighter colored pruinose hymenium, and subcylindrical to ellipsoid spores.

Section VIII

Spores nonamyloid, with smooth walls, cylindrical to ellipsoid; gloeocystidia absent; cystidia persisting in 10% KOH, nonseptate; hyphae strictly nodose-septate.

Species in this section differ from those in Section VII only in having the hyphae invariably nodose-septate. A careful examination of the hyphae is essential to exclude material belonging to Section VII, as species in that group, in addition to simple septa, may have nodose septa as well.

KEY TO THE SPECIES

1. Most or all of the spores 10–16 μ long 2
1. Spores 4–10 μ long 4
   2. Fruiting body waxy, firm ..... 68. *P. quercina*
   2. Fruiting body membranous to floccose 3
3. Spores subfusiform, 10–16 × 1.2–3 μ; cystidia with distant flattened crystals ..... 69. *P. longispora*
3. Spores subcylindrical, (7.5–)10–14 × 3–5 μ; cystidia heavily incrusted, 8–17 μ in diameter .. 70. *P. guttulifera*

3. Spores cylindrical, 10–16 × 4.5–6 μ; cystidia sparsely incrusted, 6–10 μ in diameter....71. *P. medioburiensis*
4. Spores cylindrical to suballantoid, length to width ratio 1:3–6 5
4. Spores cylindrical to broadly ellipsoid, length to width ratio 1:1–3 8
5. In section colored 6
5. In section hyaline 7
6. Spores 4.5–6 × 1.5–2 μ; cystidia thin-walled, flexuous, slightly incrusted .....72. *P. flavo-ferruginea*
6. Spores 7.5–9 × 2.5–3 μ; cystidia thick-walled, heavily incrusted.....73. *P. cinerea*
7. Cystidia small, up to 30 μ long, flask-shaped or capitate .....74. *P. romellii*
7. Cystidia large, up to 120 μ long, cylindrical...75. *P. subalutacea*
8. Spores broadly ellipsoid, length to width ratio 1:1–2 9
8. Spores cylindrical to ellipsoid, length to width ratio 1:2–3 13
9. Cystidia with one or more swellings at the tip (moniliform) .....76. *P. pilosa*
9. Cystidia uniform, thick-walled, heavily incrusted...77. *P. nivea*
9. Cystidia uniform, thin-walled, slightly if at all incrusted....10
10. Cystidia small, 30–45 × 3–4.5 μ 11
10. Cystidia large, 45–100 × 4.5–15 μ 12
11. Hyphae bearing globose, spiny cells.....78. *P. compta*
11. Hyphae even, occasionally incrusted.....79. *P. sambuci*
12. Cystidia cylindrical, 4.5–6 μ in diameter....80. *P. alienata*
12. Cystidia clavate, 8–15 μ in diameter.....81. *P. clavigera*
13. Spores 7–10 μ long 14
13. Spores 4–7.5 μ long 15
14. Cystidia subulate, 9–14 μ in diameter; hyphae loosely arranged; basidia urn-shaped.....82. *P. argillacea*
14. Cystidia cylindrical, 5–8 μ in diameter; hyphae agglutinated; basidia clavate.....83. *P. dryina*
15. Fruiting body distinctly waxy.....16
15. Fruiting body pelliculose to membranous.....19
16. Surface folded (merulioid) .....84. *P. phlebioides*
16. Surface even 17
17. Hyphae brown; cystidia thick-walled, heavily incrusted .....85. *P. pithya*

17. Hyphae hyaline; cystidia usually thin-walled, not incrusted..18
    18. Cystidia acicular, 2.5–4 μ in diameter.....86. *P. subserialis*
    18. Cystidia subulate to subfusiform, 5–7 μ in diameter .....87. *P. livida*
19. Cystidia lanceolate .....88. *P. hastata*
19. Cystidia cylindrical or fusiform 20
    20. Hyphae of two types (dimitic).....89. *P. greschikii*
    20. Hyphae all alike (monomitic).....21
21. Cystidia fusiform; hyphae distinct, of short cells .....90. *P. probata*
21. Cystidia cylindrical; hyphae irregular, difficult to separate .....91. *P. ludoviciana*

68. *Peniophora quercina* (Pers. ex Fries) Cooke Fig. 68

Grevillea 8:20. 1879. *Thelephora quercina* Pers., Syn. Fung., p. 573. 1801; Fries, Syst. Myc. 1:442. 1821. *Peniophora corticalis* (Bull. ex. Quél.) Bres., I. R. Accad. Sci. Lett. Rovereto, Atti III, 3:114. 1897.

Fructifications somewhat effused, adnate, pinkish-buff ("red at first but darkening gradually to grey-violaceous, young specimens fading after drying to ochraceous," J. Eriksson, 1950, p. 65), waxy, firm; surface somewhat odontioid, or more often irregularly folding, cracking and curling away from the substratum; margin indeterminate.

In section hyaline except for a thin brownish layer next to the substratum, 250–500 μ thick; hyphae compactly arranged, thin-walled, nodose-septate, 3–4 μ in diameter; cystidia abundant, conical, usually thick-walled, when mature heavily incrusted, immersed or projecting slightly, 30–60 × 9–15 μ; basidia subclavate, 25–35 × 5–7 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 10–12 × 3–4.5 μ.

On wood of angiosperms in New York and Germany; reported from Sweden.

This species is similar to 85. *P. pithya* and 73. *P. cinerea*. Both differ in being brownish in section and in having smaller spores up to 9 μ long.

69. *Peniophora longispora* (Pat.) Hoehn. Fig. 69

Ann. Mycol. 3:325. 1905. *Hypochnus longisporus* Pat., Jour. de Bot. 8:221. 1894. *Peniophora asperipilata* Burt (*fide* Rogers and Jackson, 1943, p. 315).

Fructifications somewhat effused, white, floccose; surface discontinuous; margin thinning out.

In section hyaline, 50–100 μ thick; hyphae vertically and loosely arranged, rather thin-walled, nodose-septate, 2–3.5 μ in diameter; cystidia abundant, cylindrical, acuminate, incrusted with uniformly separated, flattened crystals, projecting up to about two-thirds of their length, 40–80 × 4–5 μ; basidia clavate, 20–30 × 5–8 μ; spores hyaline, smooth, nonamyloid, mostly subfusiform, sometimes cylindrical and slightly curved, 10–16 × 1.2–3 μ.

On wood of angiosperms, rarely on gymnosperms, in New York, Ontario, Florida, Idaho, and France; reported as widespread in North America, Europe, West Indies, Africa, and New Zealand.

This species is easily recognized by its white, floccose fructification, its slender cystidia incrusted with discrete crystals, and its unique, long, often subfusiform spores.

Talbot (1958, p. 148) reports a new variety (var. *brachyspora* Talbot & Green) from South Africa that differs in having short spores, "elliptic-fusoid, 2.2–3.2 × 6.4–8 μ."

70. *Peniophora guttulifera* (Karst.) Sacc. Fig. 70

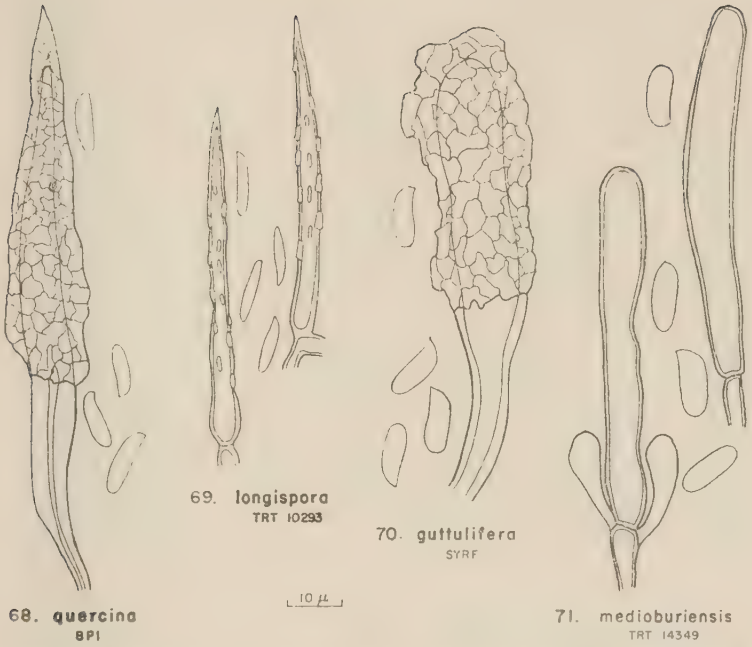
Syll. Fung. 9:240. 1891. *Gloeocystidium guttuliferum* Karst., Finl. Nat. Folk Bidr. 48:430. 1889.

Fructifications widely effused, adnate, pale brownish to yellowish, membranous; surface pilose, sometimes with minute, hard, brownish globules; margin indeterminate.

In section yellowish, 50–150 μ thick ; hyphae difficult to distinguish, irregular, fragmenting in section, rather thin-walled, indistinctly nodose-septate, 2–4 (–5) μ in diameter; cystidia abundant, cylindrical or clavate, stout, heavily incrusted with large, often yellowish granules, projecting up to 60 μ, 40–80 × 8–17 μ; basidia subclavate, 20–25 × 5–7 μ; spores hyaline, smooth, nonamyloid, subcylindrical, flattened on one side, (7.5–)10–14 × 3–5 μ.

On wood of angiosperms in New York, Ontario, and France; reported from the temperate zone of North America, and from Europe.

This species is characterized by its large, stout, heavily incrusted cystidia. The organization of the fruiting body is often difficult to distinguish. The identification value of the brownish globules found on the surface is rather doubtful, since they are of inconsistent occurrence and dissolve readily in aqueous solutions.



FIGS. 68-71. — Microscopic features of species of Peniophora, all × 750. FIG. 68. Cystidium and spores of *P. quercina*. Drawn from Sydow coll., Nov. 1895. FIG. 69. Same of *P. longispora*. FIG. 70. Same of *P. guttulifera*. Drawn from Hunt coll., Sept. 29, 1951. FIG. 71. Same of *P. medioburiensis*.

71. *Peniophora medioburiensis* Burt Fig. 71

Mo. Bot. Gard. Ann. 12:328. 1926.

Fructifications somewhat effused, in small patches, grayish ("between light grayish olive and deep olive-buff," Burt), floccose; surface interrupted; margin fibrillose.

In section zonate, upper layer dense with abundant crystals and lower free of crystals, 150–250 μ thick; hyphae loosely arranged, frequently somewhat incrusted, thin- to rather thin-walled, nodose-septate, 2–5 μ in diameter; cystidia few, cylindrical, somewhat flexuous, often sparsely incrusted, projecting up to 50 μ, 40–90 × 6–10 μ; basidia subclavate, 25–40 × 7.5–9 μ; spores hyaline, smooth, non-amyloid, cylindrical, slightly curved, 10–16 × 4.5–6 μ.

On wood of angiosperms in Ontario; not yet known from New York; reported from Vermont, Quebec, Iowa, and British Columbia.

The conspicuous zonation of the fruiting body and its large spores distinguish this species.

72. *Peniophora flavo-ferruginea* (Karst.) Litsch. Fig. 72

In Lund. & Nannf., F. Exs. Suec. 574a. 1938. *Xerocarpus ? flavo-ferrugineus* Karst., Hedwigia 34:8. 1895.

Fructifications widely effused, adnate, avellaneous, membranous, somewhat waxy; surface pruinose, cracking into small areas; margin pruinose.

In section slightly colored, with globose crystalline bodies scattered in the lower part, 100–150 μ thick, hyphae longitudinally arranged next to the substratum, then ascending, compact, irregular, thin-walled, nodose-septate, often inflated at the septa, 2–3 μ in diameter; cystidia abundant, cylindrical, attenuate, thin-walled, somewhat flexuous, slightly incrusted, immersed or projecting up to 30 μ, 40–80 × 4.5–6 μ; basidia clavate, 20–30 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 4.5–6 × 1.5–2 μ.

On wood of gymnosperms in Ontario and Sweden; not yet known from New York; reported from British Columbia and Austria.

The species is characterized by its fragile fructification which appears yellowish in section, its delicate cystidia, and its cylindrical spores.

73. *Peniophora cinerea* (Fries) Cooke Fig. 73

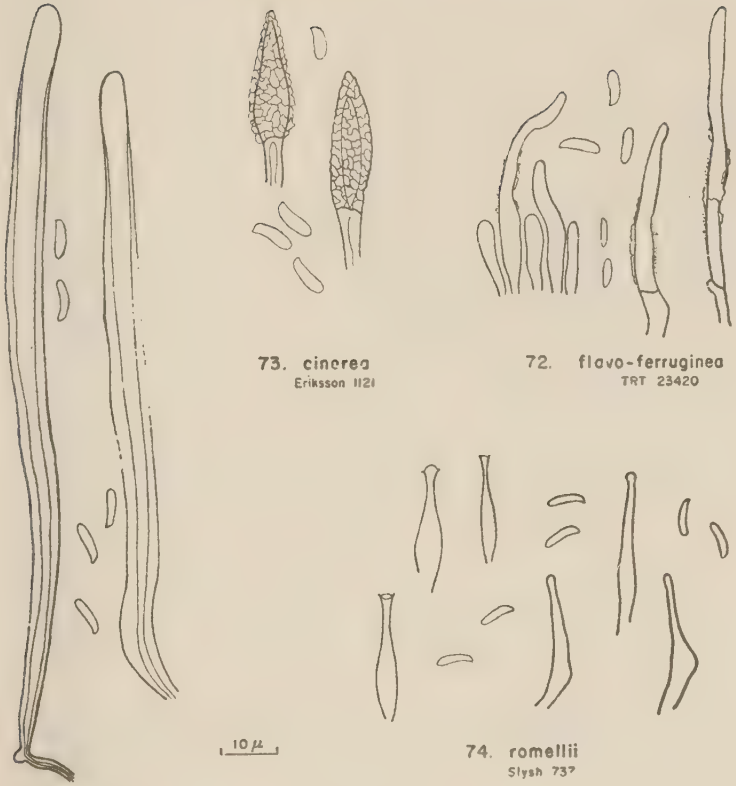
Grevillea 8:20. 1879. *Thelephora cinerea* Fries, Syst. Myc. 1:453. 1821.

Fructifications at first in small patches, becoming confluent, adnate, pale gray with a tint of pink, waxy; surface pruinose; margin narrow, minutely fibrillose.

In section brownish, 50–150 μ thick; hyphae brownish, vertically arranged, compact and indistinct, rather thin-walled, nodose-septate, 2.5–4 μ in diameter; cystidia abundant, conical, thick-walled, heavily incrusted, immersed at all levels or slightly projecting, 20–30 × 6–9 μ; basidia subclavate, 25–30 × 5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, curved, 7.5–9 × 2.5–3 μ.

On wood of angiosperms in Sweden, France, and Germany; probably a strictly European species, if considered in the sense of J. Eriksson (1950).

This species resembles closely 15. *P. violaceo-livida* and 16. *P. nuda*. Microscopically it differs from both in the absence of gloeocystidia. No. 85. *P. pithya* and 68. *P. quercina* are also similar. *P. pithya* lacks gloeocystidia, but has larger cystidia up to 70 × 20 μ and smaller spores 5.5–7 × 2–2.5 μ. *P. quercina* differs in being hyaline in section, and in having larger spores 10–12 × 3–4.5 μ.



FIGS. 72-75. — Microscopic features of species of Peniophora, all × 750. FIG. 72. Cystidia, spores, and a fragment of hymenium of *P. flavo-ferruginea*. FIG. 73. Cystidia and spores of *P. cinerea*. FIG. 74. Same of *P. romellii*. FIG. 75. Same of *P. subalutacea*.

With the use of sulfuric benzaldehyde as introduced by Boidin (1951), the taxonomic position of *P. cinerea* in American mycology has been considerably changed. Numerous collections from North America determined as *P. cinerea* by specialists differ from the European specimens in having gloeocystidia, and all are here referred to *P. violaceo-livida* and *P. nuda*. The identity and distribution of *P. cinerea* needs to be reworked using sulfuric benzaldehyde. Cultural work is also desirable, if not indispensable.

74. *Peniophora romellii* Litsch. Fig. 74
Soc. Myc. France Bul. 48:212. 1932.

Fructifications widely effused, adnate, white to cream, membranous; surface often discontinuous, cracking; margin pruinose, thinning out.

In section hyaline, 50–200 μ thick; hyphae compactly arranged, thin-walled, nodose-septate, 2–3 μ in diameter; cystidia abundant, subulate, flask-shaped or subfusiform and capitate, projecting up to 20 μ, 20–30 × 3–4 μ; basidia clavate, 10–15 × 4–5 μ; spores hyaline, smooth, nonamyloid, suballantoid, 6–9 × 1–1.5 μ.

On wood of gymnosperms in New York, Ontario, and Sweden.

The flask-shaped cystidia and suballantoid spores are diagnostic for this species. No. 79. *P. sambuci* resembles it externally but differs distinctly in its spore size, 4.5–7.5 × 3.5–4.5 μ. Both seem to be able to fruit on dry substrata and have been collected on fencing material. The New York specimen (Slysh 737) is the first recorded from the State.

75. *Peniophora subalutacea* (Karst.) Hoehn. & Litsch. Fig. 75
K. Akad. Wiss. Wien Math.-Nat. Kl. Sitzungsb. 115 (Abt. 1):1601. 1906. *Corticium subalutaceum* Karst., Soc. Faun. Fl. Fenn. Medd. 9:65. 1883.

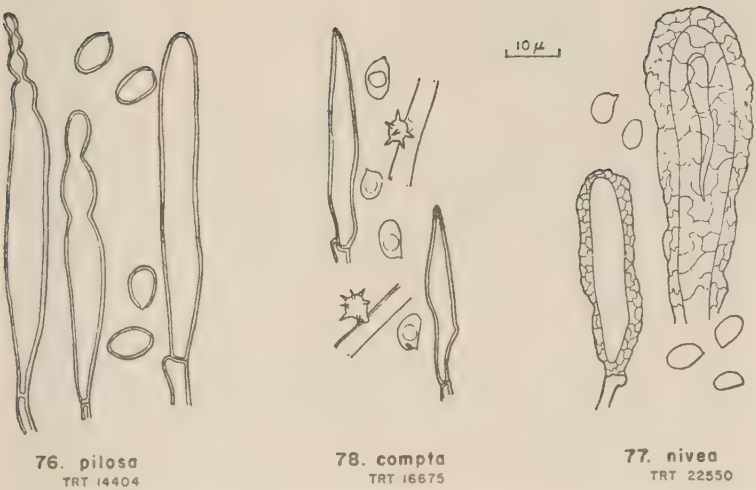
Fructifications effused, very thin, adnate, tan, appearing reticulate; surface discontinuous, minutely pilose in side view; margin thinning out.

In section hyaline, 50–150 μ thick; hyphae rather thin-walled, nodose-septate, 2–3 μ in diameter; cystidia frequent, cylindrical, slightly expanding from base to apex, walls becoming gradually thinner from base to apex (from 2 μ thick at the base to 0.3 μ at the apex), projecting up to 60 μ, 80–120 × 5–7 μ; basidia clavate, 15–20 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 6–8 × 1.5–2 μ.

On wood of gymnosperms in New York, Ontario, Idaho, Latvia, and Sweden; reported from British Columbia, England, France, Austria, and New Zealand.

This species is very similar to 31. *P. gracillima* and its relatives, except that its cystidia are not affected by KOH.

76. *Peniophora pilosa* Burt Fig. 76
Mo. Bot. Gard. Ann. 12:291. 1926.



FIGS. 76-78. — Microscopic features of species of Peniophora, all × 750. FIG. 76. Cystidia and spores of *P. pilosa*. FIG. 77. Same of *P. nivea*. FIG. 78. Cystidia, spores, and hyphae bearing globose spiny cells of *P. compta*.

Fructifications effused, adnate, pale cream, soft-membranous, reticulate; surface downy in appearance, often interrupted; margin finely floccose or arachnoid.

In section hyaline, 40–150 μ thick; hyphae loosely arranged, thin-walled, nodose-septate, 2.5–3 μ in diameter; cystidia rather rare, cylindrical, often flexuous, attenuate, sometimes terminating with one or more ovoid-shaped structures (moniliform), projecting up to 50 μ, 60–90 × 6–10 μ; basidia clavate, 20–30 × 6–7.5 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid to ovoid, with thickened walls, 6–8 (–10) × 3.5–4.5 (–6) μ.

On wood of gymnosperms in New York, Ontario, and Alabama; reported from Florida.

Ovoid terminations of cystidia are present on an average of three out of ten cystidia, and are diagnostic for this species. Some cystidia show only one, others a chain of two to four of such terminal cells. Thick walls of the spores are unique for the species here treated.

77. *Peniophora nivea* (Karst.) Bourd. & Galz. Fig. 77
Soc. Myc. France Bul. 28:394. 1913.

Fructifications widely effused, adnate, cream colored, often with pinkish tint, membranous; surface tuberculate; margin fibrillose, sometimes forming mycelial strands.

In section hyaline, up to 300 μ thick; hyphae loosely arranged in the lower two-thirds, becoming compact and indistinct toward the hymenium, somewhat incrusted, thin-walled, nodose-septate, 2–4 μ in diameter; cystidia abundant, subclavate, rarely attenuate, thick-walled, heavily and coarsely incrusted, immersed or projecting up to 25 μ, 40–80 × 8–15 μ; basidia clavate, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, ellipoid to broadly ellipsoid, flattened on one side, 4–6 × 2.5–3.5 μ.

On wood of angiosperms and gymnosperms in Ontario, Maine, France, Sweden, and Austria; not yet known from New York; reported from Germany.

The tuberculate appearance of the fruiting body and the mycelial strands in combination with subclavate, heavily incrusted cystidia are the most distinctive characters of this species. No. 2. *P. heterogenea* resembles this species, but differs in having amyloid spores.

78. *Peniophora compta* Jacks. Fig. 78

Canad. Jour. Res. 26 (C):138. 1948.

Fructifications somewhat effused, more or less adnate, creamy-white, delicate, subpelliculose; surface discontinuous; margin indeterminate.

In section hyaline, up to 150 μ thick; hyphae thin- to rather thin-walled, nodose-septate, 3–5 μ in diameter, laterally bearing sessile globose cells which are 3–5 μ in diameter and have scattered delicate spines; cystidia numerous, slender, acuminate, thin-walled, not incrusted, projecting up to 20 μ, 30–45 × 3–4.5 μ; basidia subcylindrical, 20–25 × 6–8 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid, flattened on one side, apiculate, 6–8 × 3–4.5 μ.

On wood of gymnosperms in Ontario; not yet known from New York.

The spiny cells found on the hyphae of this species are unique in the genus.

79. *Peniophora sambuci* (Pers. ex Fries) Burt Fig. 79

Mo. Bot. Gard. Ann. 12:233. 1926. *Thelephora sambuci* Pers., Roemer's Neues Mag. Bot. 1:111. 1794; Fries, Epicrisis, p. 565. 1838. *Peniophora thujae* Burt (*fide* Rogers and Jackson, 1943, p. 325).

Fructifications widely and longitudinally effused, adnate, white, becoming discolored or cream on drying, soft-membranous; surface farinose, cracking irregularly; margin concolorous, from determinate and pruinose to gradually thinning out and minutely fibrillose.

In section hyaline, 100–300 μ thick; hyphae vertically arranged, occasionally incrusted, rather thin-walled, firm, nodose-septate, 2.5–4 μ in diameter; cystidia numerous, cylindrical, tapering towards the apex, thin-walled, often minutely incrusted, or becoming capitate, projecting up to 25 μ, 30–45 × 3–4 μ; basidia cylindrical, 15–25 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, from cylindric-ellipsoid to broadly ellipsoid, 4.5–7.5 × 3.5–4.5 μ.

On wood of angiosperms and gymnosperms in New York, Ontario, Missouri, Washington, Germany, Sweden, and Ukraine; reported as widespread in North America and Europe.

No. 74. *P. romellii* is almost identical macroscopically, but differs in having cylindrical spores, 6–9 × 1–1.5 μ.

80. *Peniophora alienata* Lund. Fig. 80

Lund. & Nannf., F. Exs. Suec. 1043. 1941.

Fructifications somewhat effused, adnate, pale cream, submembranous, fragile; surface farinose, interrupted at places, minutely papillose; margin thinning out.

In section hyaline, with abundant crystals scattered throughout, 150–200 μ thick; hyphae loosely arranged, slightly incrusted in subhymenium, thin-walled, nodose-septate, 2.5–5 μ in diameter; cystidia abundant, cylindrical, flexuous, not incrusted, with slightly thickened walls, projecting up to 50 μ, 60–100 × 4.5–6 μ; basidia subclavate, 16–25 × 5–7 μ; spores hyaline, smooth, nonamyloid, broadly ellipsoid, slightly flattened on one side, 6–7.5 × 4–4.5 μ.

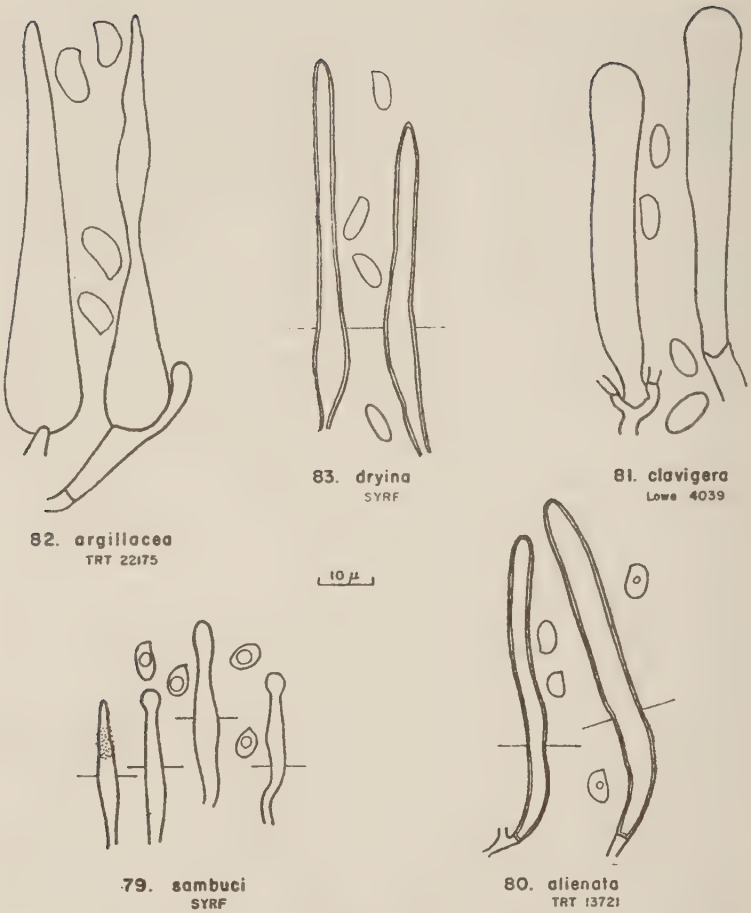
On wood of angiosperms and gymnosperms in Ontario; not yet known from New York; described from Sweden on Pinus.

This species is similar to 81. *P. clavigera* and 82. *P. argillacea*. *P. clavigera* has clavate cystidia and spores 6–9 μ long; *P. argillacea* has subulate cystidia and spores 8–10 μ long.

81. *Peniophora clavigera* (Bres.) Bourd. & Galz. Fig. 81

Soc. Myc. France Bul. 28:381. 1913. *Kneiffia clavigera* Bres., Ann. Mycol. 1:103. 1903.

Fructifications somewhat effused, more or less separable, white to cream, at first floccose, becoming pelliculose, fragile; surface farinose, interrupted; margin indeterminate.



FIGS. 79-83. — Microscopic features of species of Peniophora, all × 750. FIG. 79. Cystidia and spores of *P. sambuci*. Drawn from Hunt coll., Sept. 27, 1951. FIG. 80. Same of *P. alienata*. FIG. 81. Same of *P. clavigera*. FIG. 82. Same of *P. argillacea*. FIG. 83. Same of *P. dryina*. Drawn from Brown coll., Nov. 30, 1925.

In section hyaline, 75–200 μ thick; hyphae loosely arranged, somewhat incrusted, thin-walled, nodose-septate, 2.5–4 (–6) μ in diameter; cystidia abundant, clavate or "obovales" (Bourdot and Galzin, 1928, p. 280), thin-walled, not incrusted, projecting up to 40 μ, 45–100 × 8–15 μ; basidia clavate, 25–35 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical to broadly ellipsoid, apiculate, flattened on one side, 6–9 × 4–5 μ.

On wood of angiosperms in Georgia and France; not yet known from New York; reported from Ontario and Manitoba.

This species is characterized by its thin-walled, clavate cystidia. These distinguish it from 82. *P. argillacea*, which differs in having subulate cystidia.

82. *Peniophora argillacea* Bres. Fig. 82
Fung. Trid. 2:63. 1898.

Fructifications somewhat effused, often in patches, white to tan, floccose, with a very scanty subiculum; surface discontinuous, pruinose; margin thinning out.

In section hyaline, up to 90 μ thick; hyphae loosely arranged, often of short cells, sometimes slightly incrusted, thin-walled, nodose-septate, 3–6 μ in diameter; cystidia abundant, subulate, thin-walled, flexuous, often collapsed, projecting up to 80 μ, 75–100 ("–200," Bourdot and Galzin, 1928, p. 279) × 9–14 μ; basidia urn-shaped, 20–30 × 4–7 μ; vesicles distinct, ellipsoid, originating in the same manner as basidia, 12–16 × 8–10 μ; spores hyaline, smooth, non-amyloid, ellipsoid, flattened or slightly curved on one side, with a prominent apiculus, 8–10 × 4–5 μ.

On wood of angiosperms, gymnosperms, and on fungal tissue in Ontario, Michigan, France, and Austria; not yet known from New York.

The subulate, thin-walled cystidia are characteristic for this species. No. 81. *P. clavigera* differs mainly in having clavate cystidia.

83. *Peniophora dryina* (Berk. & Curt.) Rog. & Jacks. Fig. 83
Farlowia 1:277. 1943. *Corticium dryinum* Berk. & Curt., Grevillea 1:179. 1873. *Peniophora tabacina* Burt and *Coniophora crocea* Karst. (*fide* Rogers and Jackson, 1943, p. 278 and 277).

Fructifications somewhat effused, adnate, pale yellowish-brown to dark brown, membranous, slightly waxy; surface rugulose, slightly pilose, occasionally cracking; margin paler, fibrillose.

In section colored, 150–300 μ thick; hyphae compactly interwoven, some irregular and agglutinated and only the lumen showing distinctly in stained preparations, otherwise distinct, thin- to rather thin-walled, nodose-septate, 3–6 μ in diameter; cystidia few, cylindrical, with slightly thickened walls, sometimes vesiculose at the base, not incrusted, projecting up to 70 μ, 50–100 × 5–8 μ; basidia clavate, 20–25 × 4.5–6 μ; spores hyaline or slightly colored, smooth, cylindrical to oblong-ellipsoid, apiculate, 7–9 × 3–4 μ.

On wood of gymnosperms in Oregon, Washington, and British Columbia; not yet known from New York; reported from Ontario, Virginia, Missouri, Wisconsin, Colorado, and Idaho.

P. dryina externally resembles a species of Coniophora. In that respect it is also similar to 62. *P. filamentosa* which differs, however, in its rhizomorphic margin, in its strictly hyaline and smaller spores, 4–5.5 × 2–3 μ, and in its simple-septate hyphae.

84. *Peniophora phlebioides* Jacks. & Deard. Fig. 84
Canad. Jour. Res. 27(C):150. 1949.

Fructifications somewhat effused, adnate, cream, waxy; surface folded, merulioid, occasionally cracking; margin thnning out.

In section hyaline, 50–200 μ thick; hyphae compactly arranged, with rather thin and gelatinized walls, nodose-septate, 2–3 μ in diameter; cystidia abundant, acicular, projecting up to 30 μ, 25–50 × 3–4.5 μ; basidia subclavate, 15–25 × 3.5–4.5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 5–6.5 × 2–2.5 μ.

On wood of gymnosperms in New York and British Columbia.

The characteristic features of this species are its folded hymenium, acicular cystidia, and the gelatinized walls of hyphae. No. 86. *P. subserialis* is closely related but differs in having an even hymenium, and yellowish crystalline bodies in the context. The New York collections (Slysh 1198, 1200) were identified by Weresub and represent the first record from the eastern United States.

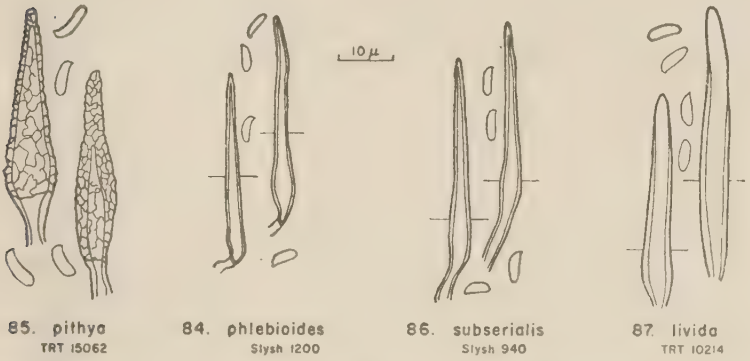
85. *Peniophora pithya* (Pers.) J. Erikss. Fig. 85
Symb. Bot. Upsal. 10 (5):45. 1950. *Thelephora pithya* Pers., Mycol. Eur. 1:146. 1822.

Fructifictions widely effused, adnate, purplish-brown, waxy, firm; surface minutely pilose; margin pruinose.

In section two-layered, composed of a layer next to the substratum of horizontally arranged brown hyphae, and an upper layer of vertically arranged brown to hyaline hyphae, both 50–150 μ thick; hyphae compactly arranged, indistinct, thin- to thick-walled, nodose-septate, 2.5–3.5 μ in diameter; cystidia abundant, scattered throughout, conical to subfusiform, thick-walled, heavily incrusted, projecting up to 20 μ, 30–70 × 8–20 μ; basidia subclavate, 20–25 × 4–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 5.5–7 × 2–2.5 μ.

On wood of gymnosperms, rarely of angiosperms in Ontario; not yet known from New York; reported as widespread in Europe and North America.

No. 16. *P. nuda* and 15. *P. violaceo-livida* are similar but can be separated by the presence of gloeocystidia. No. 73. *P. cinerea* has smaller cystidia, 20–30 × 6–9 μ, and larger spores, 7.5–9 × 2.5–3 μ. No. 68. *P. quercina* is hyaline in section and has large spores 10–12 × 3–4.5 μ.



FIGS. 84-87. – Microscopic features of species of Peniophora, all × 750. FIG. 84. Cystidia and spores of *P. phlebioides*. FIG. 85. Same of *P. pithya*. FIG. 86. Same of *P. subserialis*. FIG. 87. Same of *P. livida*.

86. ***Peniophora subserialis*** (Bourd. & Galz.) Slysh, comb. nov.
Fig. 86

Corticium subseriale Bourd. & Galz., Hymén. France, p. 219. 1928. *Kneiffia serialis* (Fries) Bres., Ann. Mycol. 1:102. 1903.

Fructifications somewhat effused, adnate, yellowish, waxy; surface pruinose; margin pruinose.

In section hyaline, with conspicuous crystalline, globular, yellowish masses in the lower half, 70–110 μ thick; hyphae compactly arranged, gelatinized, rather thin-walled next to the substratum, becoming indistinguishable in the subhymenium, nodose-septate, 2.5–4 μ in diameter; cystidia abundant to rare, acicular, not incrusted, projecting up to 35 μ, 30–50 × 2.5–4 μ; basidia narrowly clavate, 20–35 × 3–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved or flattened on one side, 5–7 × 2–2.5 μ.

On wood of gymnosperms in New York, France, and Austria; reported from Poland.

The cystidioles of *Corticium subseriale* are prominent enough to be called cystidia and thus to justify the transfer of the species to the genus Peniophora.

The above description is based on a specimen named by Bourdot (Bourdot 5103 in N. Y. Bot. Gard. Herb. as "*P. serialis* (Fries) Bres.", a specimen of Litschauer (Litschauer Herb. 24 in Univ. of Toronto Herb., as "*Corticium subseriale* Bourd. & Galz."), and my own collection Slysh 940, determined by R. F. Cain. It agrees well with Bourdot and Galzin's description of *C. subseriale* Bourd. & Galz. *C. seriale* (Fries) Bourd. & Galz. is a different species, as is apparent from Bourdot and Galzin's description which gives the spores of that species as oblong-ellipsoid or obovate, 3–4.5 × 2–2.5 μ.

87. *Peniophora livida* Burt Fig. 87
Mo. Bot. Gard. Ann. 12:239. 1926.

Fructifications widely effused, adnate, white to cream, waxy; surface even, minutely pilose; margin thinning out.

In section hyaline, 50–200 μ thick; hyphae compactly arranged, indistinct, gelatinized, thin- to thick-walled, rarely nodose-septate, 2–3 μ in diameter; cystidia few, subulate to subfusiform, with slightly thickened walls, not incrusted, projecting up to 30 μ, 30–60 × 5–7 μ; basidia subclavate, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 5–7.5 × 2–3 μ.

On wood of gymnosperms, rarely of angiosperms, in Ontario, British Columbia, and Sweden; not yet known from New York; reported from Louisiana and Austria.

No. 86. *P. subserialis* is similar but differs in having slender acicular cystidia 2.5–4 μ in diameter. The species was published on the basis of an undescribed specimen given the herbarium name of *Corticium lividum* by Fries.

88. *Peniophora hastata* Litsch. Fig. 88
Oesterr. Bot. Zeitschr. 77:130. 1928.

Fructifications widely effused, separable, white to cream, floccose, becoming pelliculose; surface pruinose, interrupted; margin indeterminate.

In section hyaline, 100–150 μ thick; hyphae loosely arranged, firm, thin- to thick-walled, nodose-septate, 2–3 μ in diameter; cystidia abundant, lanceolate, not incrusted, with slightly thickened walls, sometimes flexuous, projecting up to 20 μ, 25–45 × 4.5–6 μ; basidia clavate, 15–20 × 4.5–6 μ; spores hyaline, smooth, nonamyloid, cylindrical, slightly curved, 5–6.5 × 2–2.5 μ.

On wood of gymnosperms, rarely on angiosperms, in New York, Ontario, and Sweden; reported from Austria.

FIGS. 88-91. — Microscopic features of species of Peniophora, all × 750. FIG. 88. Cystidia and spores of *P. hastata*. FIG. 89. Same of *P. greschikii*. FIG. 90. Same of *P. probata*. FIG. 91. Same of *P. ludoviciana*. Incrusted cystidium drawn from type (in FH).

The lanceolate cystidia are distinctive for this species. As suggested by Litschauer it resembles 38. *P. byssoides,* which differs in having long, cylindrical, clamped cystidia.

The determination of the New York collection (Slysh 520) was confirmed by Weresub. It is the first record for the State.

89. *Peniophora greschikii* (Bres.) Bourd. & Galz. Fig. 89

Hymén. France, p. 300. 1928. *Corticium greschikii* Bres., Rev. Mycol. 12:109. 1890. *Peniophora subcremea* Hoehn. & Litsch. and *P. alba* Burt (*fide* Rogers and Jackson, 1943, p. 311).

Fructifications widely effused, adnate, white to ivory, "subpelliculose" (Bourdot and Galzin); surface even, occasionally cracking; margin concolorous, indeterminate.

In section hyaline, 100–200 μ thick; hyphae vertically and loosely arranged, of two kinds, some thin-walled, and some almost solid, both distinct, nodose-septate, 2.5–3.5 μ in diameter; cystidia rare, cylindrical to subfusiform, not incrusted, thin-walled, projecting up to 30 μ, 40–50 × 4.5–6 μ; basidia narrowly clavate, 10–20 × 4–6 μ; spores hyaline, smooth, nonamyloid, subcylindrical to ellipsoid, apiculate, 4–6 × 2–2.5 μ.

On wood of gymnosperms in New York, Ontario, and Montana; reported from the temperate zone of North America and Europe.

The presence of two types of hyphae in this species is unique in the genus. J. Eriksson (1958) creates a new genus (Fibricium) on the basis of this character.

90. *Peniophora probata* Jacks. Fig. 90

Canad. Jour. Res. 26(C):134. 1948.

Fructifications "broadly" (Jackson) effused, separable, white to ochraceous, membranous, "becoming subceraceous" (Jackson); surface often cracking, farinose; margin white, arachnoid.

In section hyaline, 75–150 μ thick; hyphae loosely arranged, of very short, irregular cells, thin-walled, distinctly nodose-septate, 3–7.5 μ in diameter; cystidia few, fusiform, thin-walled to thickened (in the upper third), wholly to sparsely or not at all incrusted, projecting up to 30 μ, 45–60 × 8–12 μ; basidia subclavate, 20–30 × 3–4.5 μ; spores hyaline, smooth, nonamyloid, ellipsoid to oblong-ellipsoid, flattened on one side, 5–6 × 2.5–3 μ.

On wood of gymnosperms in Ontario; not yet known from New York.

The species is characterized by the peculiar, short-celled hyphae in combination with the fusiform cystidia.

91. *Peniophora ludoviciana* Burt Fig. 91

Mo. Bot. Gard. Ann. 12:244. 1926 *P. flammea* Burt, Mo. Bot. Gard. Ann. 12:252. 1926.

Fructifications widely effused, adnate, "brilliant greenish yellow — Primuline Yellow, Old Gold, Olive Lake (R) — and soft-waxy when fresh" (Rogers and Jackson, 1943, p. 316), becoming cinnamon-brown to brownish buff on drying, membranous; surface rough, minutely pilose; margin paler, thinning out.

In section somewhat pinkish in the upper part, 50–200 μ thick; hyphae obscure and irregular, incrusted in the subhymenium, thin-walled, nodose-septate, 2–4 μ in diameter; cystidia rare, cylindrical, from thin-walled and not incrusted to heavily incrusted, immersed or projecting up to 25 μ, 20–40 × 5–9 μ; basidia subcylindrical, 15–20 × 4–5 μ; spores hyaline, smooth, nonamyloid, oblong to oblong-ellipsoid, flattened on one side, 4–6 (–7.5) × 2–3 (–3.5) μ.

On wood of gymnosperms and angiosperms in Ontario, Michigan, Louisiana, Florida, and Cuba; not yet known from New York; reported from Alabama, Texas, and Bermuda.

The spores of the type collection are slightly longer than reported by Burt in his description of the species. Burt gives the spore length as 4–5 μ. According to Rogers and Jackson (1943, p. 316) the species is easily recognized in fresh condition because of its brilliant greenish-yellow fructifictaion. Old specimens become cinnamon-brown and may be occasionally confused with darker specimens of 55. *P. sulphurina* which differs in having a rhizomorphic margin and, at least in part, simple-septate hyphae.

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